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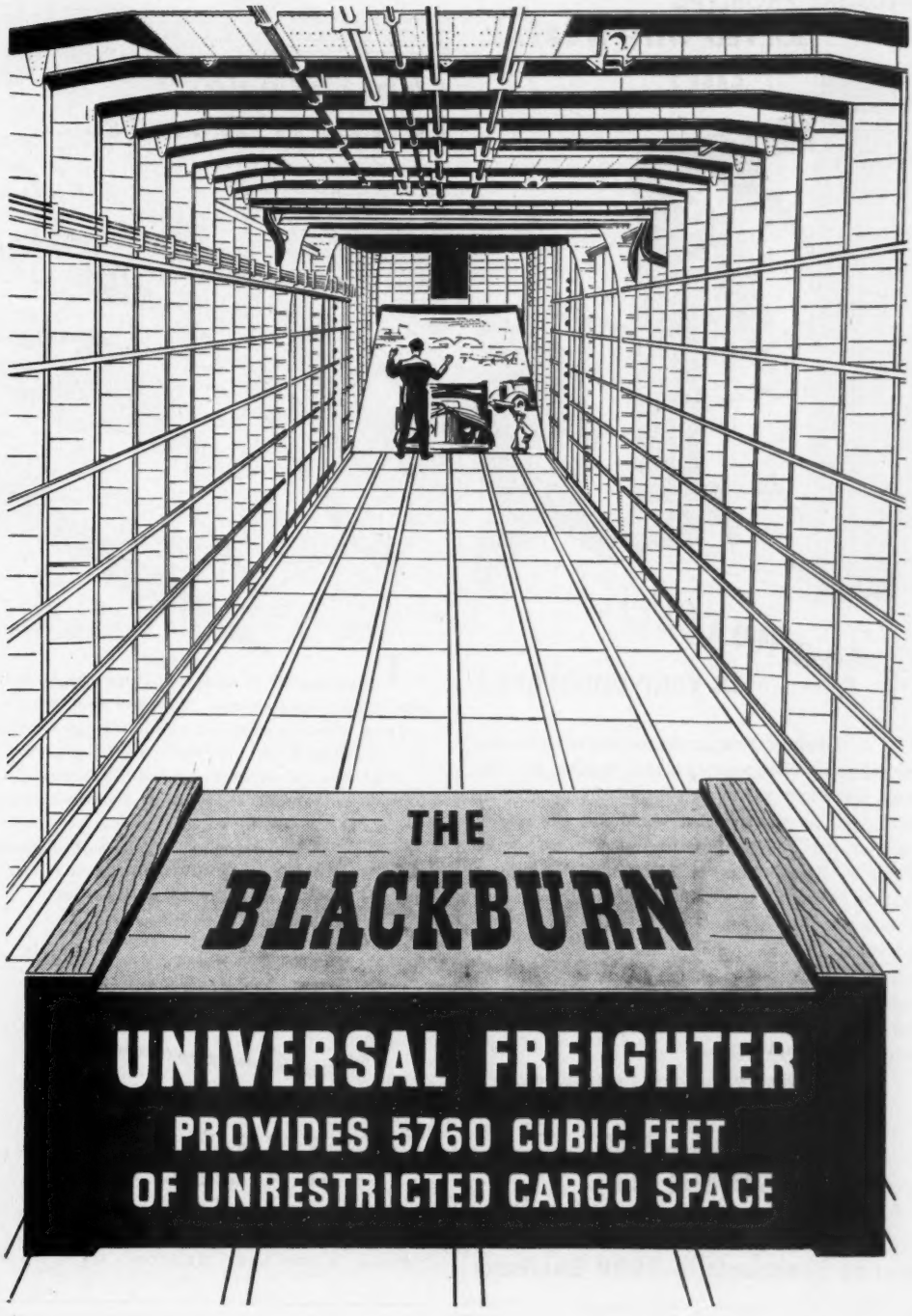
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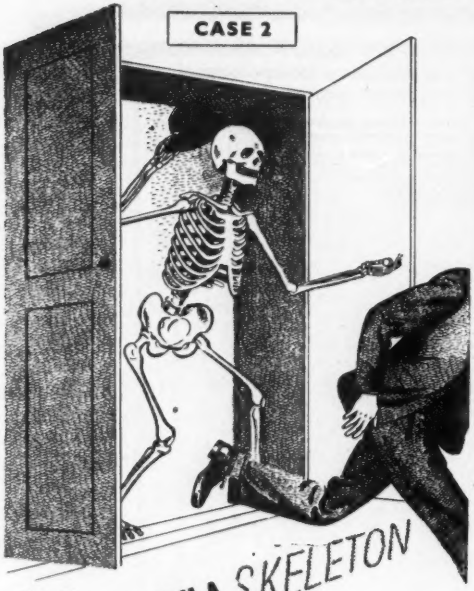

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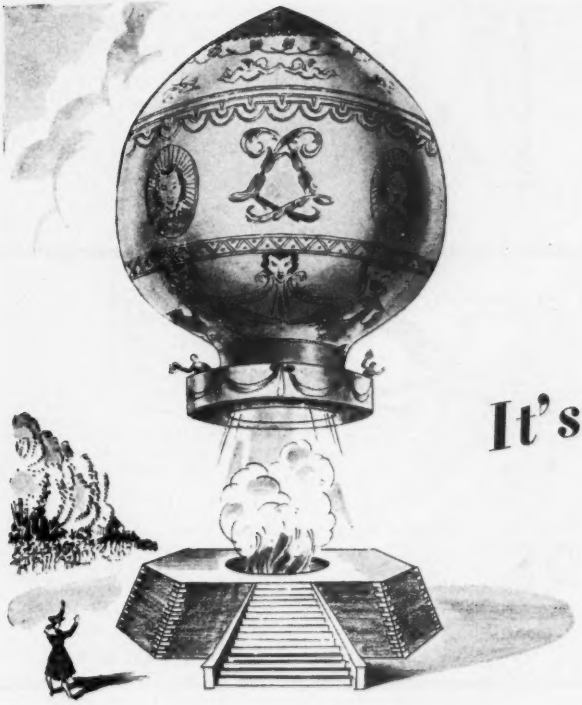

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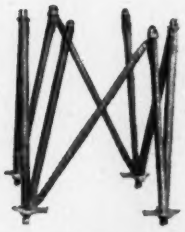

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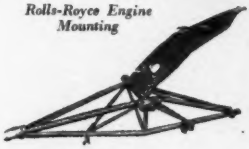

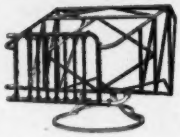

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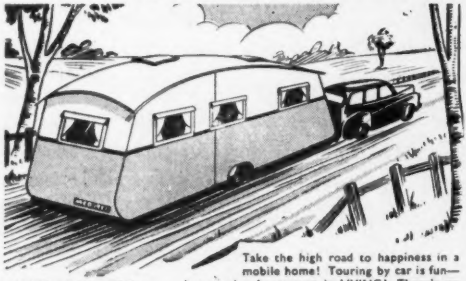

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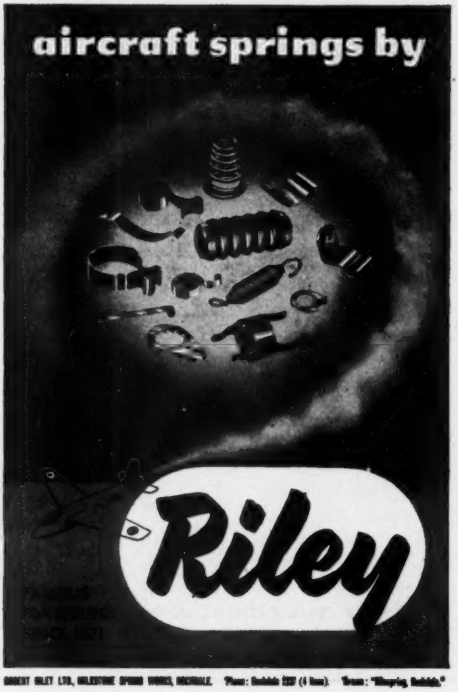

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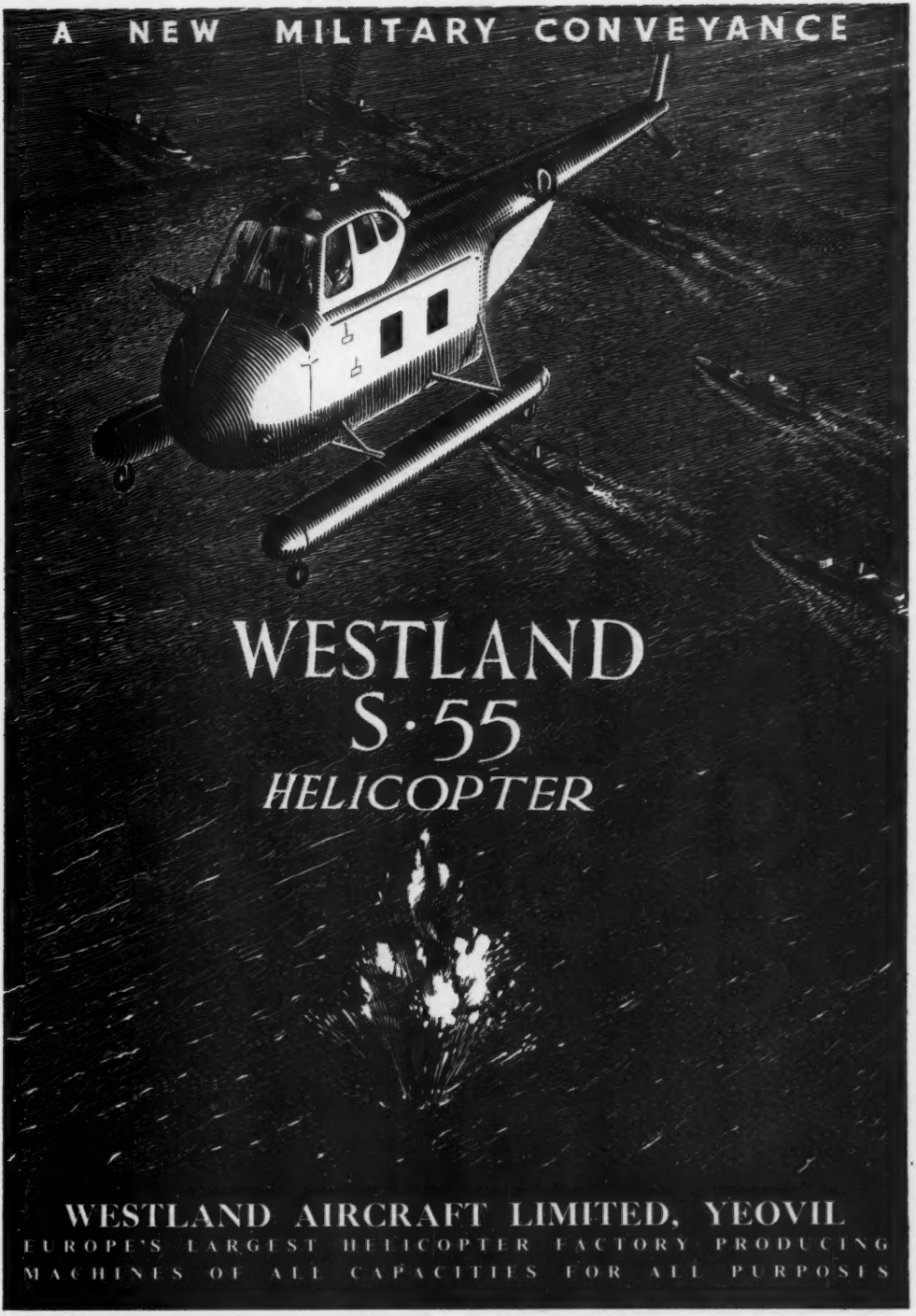
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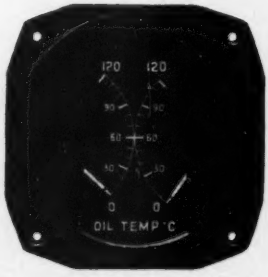

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The Umbrella Opens—Slowly

EXERCISE OMBRELLE, designed to test the air defences of Europe and involving 500 or more aircraft of six N.A.T.O. powers, came to an end last Friday night. The opening phase is dealt with overleaf, but pending conclusion of our first-hand account some general impressions may be set down here. Before this is done, it must be remarked that Ombrelle, extensive though it was, will be quite overshadowed by Exercise Cirrus, planned for September this year. As explained in our account, Ombrelle was a sequel to last year's Cupola and was intended to afford an opportunity of testing the more eastern communications (especially the complicated and expensive landline system) which were unavailable, or little used, in the former exercise.

The last word on the outcome of Ombrelle has not yet been spoken, nor is likely to be for many weeks to come; but what can be said with certainty is that the exercise was successful in putting to the test the relatively few operational units involved and the all-important communications network without which they would be hamstrung in time of crisis. Difficulties—a lack of modern airfields among them—were officially admitted at the conclusion of the exercise, but as Ombrelle involved operational procedures with which Cupola was not concerned, these were not wholly unexpected and there was, in any case, a tangible improvement in some respects as the operation progressed from phase to phase.

Especially valuable, it seems, were the exercises in deployment—for instance, the moving of a B.A.F.O. squadron of Vampire fighter/bombers some 300 miles, from Volkel in Holland to Luxeuil in France, where it was superimposed on a French Vampire wing. This was the more satisfactory in that the ground personnel were air-lifted in *Belgian* transport aircraft, and so quickly did they settle down that their Vampires were operating on the day following the transfer.

Less reassuring were the successes of the "rats"—the low-level daylight intruders—for, though on one occasion the commander of a defensive wing had a patrol ready for the marauders, severe damage might have been inflicted by other attacks, especially one involving 24 Vampires from a B.A.F.O. station. The preparations for this exhilarating (but, in its significance, discomforting) assault were witnessed in Germany by our representative and will be described next week.

There are various explanations of the ability of the "rats" to surprise and elude the defenders. First, there was no visual spotting organization, and it must be understood that until the countries of Western Union produce bodies of keen-eyed, recognition-trained enthusiasts such as we ourselves are fortunate enough to have in our own Royal Observer Corps, there must be grave concern on this score. The job of the "rat-catchers," of course, was rendered more difficult and exasperating because in many cases the raiding aircraft, like their own, were Vampires, and though distinguished by broad black bands their identification under certain conditions must have been well-nigh impossible.

Though the night-fighter effort in general was described by a senior officer as "most successful" it is well to remember that the aircraft concerned were the still-useful, but fast-ageing, Mosquitoes, and it is earnestly to be hoped that these will very soon be augmented by the two-seater radar-equipped Meteors and Venoms now in production, but already overdue in service. And while touching on the equipment problem it may be reiterated that swept-wing day fighters, capable, like the American Sabre and Soviet Mig-15, of speeds in excess of 650 m.p.h., are most urgently—some very experienced officers would say desperately—needed in Great Britain and Europe. It seems that some people, who should know better, are deriving comfort from the recollection that the Battle of Britain Hurricane, though slower than the opposing Me 109 wrought great execution among the German fighters. But let them remember that the discrepancy in speed was relatively little, and the Hurricane, moreover, possessed an inordinately effective armament and other valuable assets lacking in its opponents.

In a few words Exercise Ombrelle gives ground for considerable congratulation, but also for very real concern. It is vital that Cirrus should ease this concern.

EXERCISE OMBRELLE

Part I: The General Scheme: With the Vampires at Soesterburg and Volkel

BY H. F. KING, M.B.E.

"Flight" photograph
Mr. Arthur Henderson, Secretary of State for Air, drops in on a Bofors gun team of the R.A.F. Regiment at Volkel, where R.A.F. Vampires were based.

IF one must go to war, one may as well go in comfort, and there are many less agreeable conveyances than a Vickers Valetta of R.A.F. Transport Command. In one of the rearward-facing troop-seats of a 30-Squadron Valetta (these seats are infinitely easier on the anatomy than the traditional Dakota-type benches), we undercut B.E.A.'s Northolt-Le Bourget time by a good 15 minutes; so it was no fault of the R.A.F. or of Vickers-Armstrongs that we were late for the conference convened at the French Air Ministry, in the Boulevard Victor, Paris, on the morning of May 22nd to introduce Exercise Ombrelle.

It was while waiting for admission to this conference, incidentally, that we noticed the new French Air Force recruiting posters displayed in profusion and depicting various types of service aircraft—Vampire, Ouragan, Nord 2500, and so on; but especially the Vampire, for today machines of this type form the backbone of France's fighter defence.

Eventually we were conducted to the conference room, and found A.V-M. W. A. D. Brook, Chief of Staff, Allied Air Forces, Central Europe, assisted by General G. de Chassy (France), the Deputy Chief of Staff, explaining various aspects of the imminent exercise. A.V-M. Brook was presiding on behalf of his C-in-C., Lt. Gen. Lauris Norstad, who took over his command a few weeks ago. Ombrelle, he told us, was primarily an air-defence exercise covering the eastern portion of the national territories of Holland, Belgium, and Northern France. It was, in fact, a sequel to Exercise Cupola, the first of its kind, held last August under the auspices of the Western Union Defence Organization and described in *Flight* of August 31st, 1950. (Cupola, it may be remembered, covered the more westerly regions of the continental air-defence system.) In its turn, Ombrelle was the prelude to Exercise Cirrus, scheduled for September this year. Much bigger forces would then be engaged (though it was admitted that over 500 aircraft participated in Ombrelle), and wider aspects of defence would be involved.

A.V-M. Brook said that real progress had been made in the nine months since Cupola in developing the defensive system; whatever might be the ultimate size and shape of that system the available forces and controlling machinery must be prepared for instant action in the event of a crisis. The air vice-marshal emphasized that air warfare did not restrict itself to operational zones precisely related to the region to be defended, and that zones of activity would inevitably overlap. This being so, N.A.T.O. fighters might be called upon to operate at a considerable distance from their national sectors and under the immediate direction of a control organization in a neighbouring sector. Moreover, in the ebb and flow of air warfare both air-defence and tactical air forces might be simultaneously assigned to similar duties and must, therefore, be prepared for direction by each other's control organizations. In brief, all fighter air forces, whether tactical or air-defence, must be practised in a common control procedure and be capable of working under each other's direction without difficulty or delay. Such exercises as Ombrelle were of the greatest value in allowing fighters of various nationalities to be employed collectively and to operate from bases unconnected with their normal duties. On the occasion of Ombrelle six N.A.T.O. powers—Denmark, Holland, Belgium, France, Great Britain and America—had contributed forces.

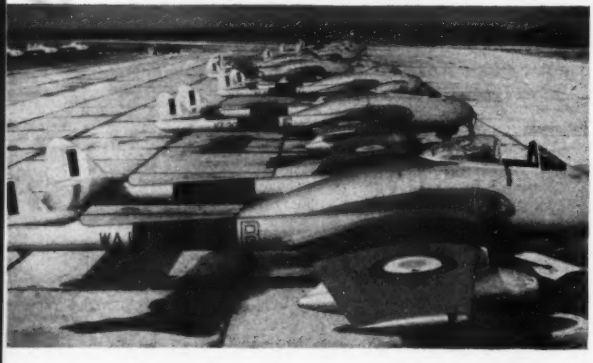
The air vice-marshal made it clear that the exercise of forces was only one aspect of Exercise Ombrelle; of equal, if not greater importance, was what he termed "the practical trial of control and reporting facilities".

Yet another consideration was the re-deployment of air forces at short notice—that is, the transference of complete units with their ground staff and equipment to new, and perhaps far-distant, bases, without loss of efficiency. This presupposed not only a common operational procedure, but a measure of standardization in equipment.

Of the "enemy" forces engaged in Ombrelle, A.V-M. Brook said that these would comprise bomber and training elements from the R.A.F. and U.S.A.F. in Europe. They would be directed against a variety of targets, such as ports, centres of communications and certain military objectives in France, Belgium and Holland. Not the least of the problems involved would be the identification of hostile and friendly aircraft by the fighters and the anti-aircraft forces.

The officer responsible for the main tactical decisions would be General Norbert Leboutte (brother of Gen. Lucien Leboutte, the Belgian Air Force's Chief of Staff), and at his headquarters, some 80 miles north-west of Paris, would be a team of advisers from the six countries concerned. Defensive squadrons were disposed as follows: *Belgium*—at Beauvechain and Chievres, Mosquito 30 night fighters and Meteor 4s of the Belgian Air Force; at Florennes, U.S.A.F. Thunderjets (F-84E); at Coxyde and Deurne, Belgian Spitfire 22s. *France*—at Luxeuil, French Vampire 5s, and at Rheims, U.S.A.F. Thunderjets (F-84E). In *Luxembourg* would be more French Vampire 5s, and in *Holland*, R.A.F. Vampires of the same mark (from B.A.F.O.) would operate from Soesterburg and Volkel, while Dutch and Danish Meteor 5s would be based at Gilze Rijen. Dakota transports of the Belgian Air Force were to be available at Melsbroek and C-82 Packets of the U.S.A.F. at Rhein/Main. Advanced landing grounds were at Coblenz and Kaiserslautern, and the airfields Twente, Leeuwarden and Brustem were available for diversions. Active phases of the exercise were: (1) 1000-1600 hr, May 23rd; (2) 0900-1300 hr, May 24th and 1800-0001 hr, May 24th/25th; (3) 1300-1900 hr, May 25th.

Thus having formed an idea of the scope and objects of Ombrelle, we set out in the Valetta next morning (May 23rd) to look in on



"Flight" photograph
"Enemy" Vampire 5s, identified by broad black bands on wings and booms, at their base in Germany. They had many successes.

the R.A.F. Vampire squadrons at Soesterburg and Volkel. From Le Bourget, where a contrast in military transports was presented by a glistening Canadair North Star of the R.C.A.F. and resident Ju 52s of l'Armee de l'Air, Soesterburg is about 1 hr 20 min flying. While in the circuit there we could see the paraphernalia of war disposed around the airfield—Bofors and Bren guns of the R.A.F. Regiment, clutches of drop-tanks for the silver Vampire F.B.5s arrayed on the tarmac, M/T. vehicles and the rest, for the exercise did not call for complete camouflage or dispersal of material. The yellow Oxfords and Harvard trainers of the Dutch Air Force were taking a back seat.

We were met outside our paratroop door by G/C. Stapleton, who told us that 20 seconds after Phase 1 of the exercise had opened at 1000 hr that morning the occupying squadrons had been nibbled at (perhaps with seriously embarrassing effect) by two "rats" in the shape of opposing B.A.F.O. Vampires. There had been no warning, for the Dutch Observer Corps was not operating, and although defensive Vampires were off within two minutes, the tiresome rodents had, of course, bolted, having the same speed as their opponents. Such internicine conflicts, we reflected, are among the more regrettable and confusing factors in air exercises and are another reason for hastening the Swifts, Canberras and Vickers 660s for an air force so largely composed of Vampires and Meteors.

The group captain did not disguise his satisfaction with the manner of his Wing's move from Wunsdorf—250 miles by road in 15-20 hr, with stops only for refreshment, completed without mishap, and with only small mechanical troubles. Some 150 vehicles and 850 men were involved, for the complete Wing of three Vampire squadrons (two from Wunsdorf, one from Celle) was entirely self-supporting. For example, it generated its own power, by diesel generator, for the V.H.F. equipment, runway lights, control caravans, and so on.

The Wing was under the control of the Group Operations Centre, which we were to visit next day, and was in communication with the Centre by landlines, standby V.H.F. and an emergency W/T. link. The controller at Group passed his instructions to the Operations and Air Traffic Control centre of the Wing and the squadrons at dispersal were brought to the required state—"available" (30 min or 15 min), "readiness" or "standby"—by field telephone. A "scramble" was ordered—though we were not fortunate enough to witness one at close quarters—by the firing of a signal light. Preliminary operational instructions, including the first vector, were given over the R/T. and confirmed by field telephone.

Not only the Wing itself, but, to a very large extent, each of the three component squadrons, was self-contained, having its own bowsers and servicing teams and charging its own batteries. Superimposed on the normal maintenance set-up was a mobile servicing team acting under V.H.F. instructions and equipped to rectify most troubles beyond the capacity of a squadron.

"Flight" photograph

Lt.-Gen. Lauris Norstad (right), American Commander-in-Chief, Allied Air Forces, Central Europe, takes leave of Lt.-Col. P. F. E. Janssens of the Dutch Air Force, at Volkel.

As we saw them, the Vampires were parked at close intervals and though the placing of so many eggs in a basket eases the task of the wily "rat", it must be remembered that the disposition of fighters on an airfield has to be reconciled with quick get-away and in these continental exercises (as at Soesterburg) may be largely dictated by available standing area.

The main runway at Soesterburg, it seems, is of Dutch tarmac, bonded with straw and laid on bricks. Like so many others used in the exercise it had fared badly under war-time bombing and the craters had been filled with brick. Consequently, the surface is hardly of billiard-table smoothness and is certainly not improved by the jet-blast of Vampires. In this connection it may be remarked that the Vampire, though having only a single jet, is less kind to a runway than the twin-jet Meteor, for it sits on its undercarriage at such an angle that the hot gases impinge on the surfacing for most of the take-off run, whereas with the Meteor the blast effect is considerable only after the nosewheel is off, and even then burning is not severe. One gathered that the present Soesterburg runway extensions are in preparation for the arrival of Dutch Meteors.

We noted that, though operating on this occasion solely in the intercepter role, the Vampires nevertheless carried the standard air-to-ground R.P. rails. As we had seen, their auxiliary fuel tanks were lying ready to hand, and the aircraft were operating with internal fuel only, the reason being that within their particular radar cover the extra tanks were unnecessary. Had the course of the exercise rendered it necessary, however, they could be affixed to the Vampires' wings in a very few minutes. It is very necessary, of course, that the fighter/bomber class of aircraft should be readily amenable to interchange and replenishment of loads, and training has enabled a Vampire 5 squadron to be, fully fuelled, rearmed with cannon ammunition and rockets and turned round in 17 minutes.

An Early Interception

On the morning of our visit the Soesterburg Vampires had had some important customers. Vectored on to an incoming raid, four of them found their quarry to be three B-50s, escorted by a dozen Thunderjets. The time was 1051 hr; the point of interception, 10 miles S.E. of Arnhem, at 25,000 ft. Passes were made at the bombers but the F-84s were reported as being "difficult to attack," though, whether this was due to their being positioned above the bombers or to a superiority in speed, we had no opportunity of discovering.

As we walked back to the Valetta we saw that the Dutch flag was at half-mast and learned that this was in respect to the pilots of two Meteors which had collided on the previous day over Germany. As happened with exasperating regularity, both during Cupola and Ombrelle, we were hardly installed for departure when we heard Goblins winding up to a scream and glimpsed four of them, on business bent, scurrying down the runway, leaving a dusty wake behind them.

We were bound for the Dutch airfield at Volkel, where we hoped to meet General Norstad and Mr. Arthur Henderson, the Air Minister having flown over from Northolt on the previous day in a V.I.P. Valetta for a two-day tour. Volkel is a mere 10 or 15 minutes flying from Soesterburg and there, again, we saw from the air the uninvitingly upturned muzzles of Bofors guns, the brown tents and the armed sentries. As our Valetta was in the circuit a Vampire was seen scrambling and our pilot gave it plenty of sky-room. On taxying in we glimpsed Thunderjets in the hangars and later learned that these—four of them—are the first to be delivered to the Dutch Air Force. They were not active in Ombrelle.

We were too late to meet General Norstad, but we did see him go aboard his magnificent Skymaster to visit Eindhoven. This C-54 must be among the best-equipped transport aircraft now flying; especially were we struck by the cloud-warning radar in the nose and the power-winch-operated collapsible passenger-steps. But though we were denied our hoped-for talk with the General, we did find Mr. Arthur Henderson as he made his solicitous way through the lines of the R.A.F. Regiment. The Minister told us that on the previous night he had been the guest of General Norstad at Wiesbaden and that before flying home he would be visiting all the Air Forces engaged, except the French, with whom he spent much of his time during Cupola. With General Norstad he had already called in at Florennes and Beauvechain and had watched scrambles by Belgian Meteors and American Thunderjets. That night he was to be the guest of the British Ambassador at the Hague and would meet members of the Netherlands Government.

One gathered that at Volkel the Dutch Air Force was supplying the British guest-squadrons with tents, fuel, M/T., etc., and that, in general, co-operation was excellent; but so that the visitors should not make themselves too much at home one squadron was to be switched to Luxeuil, in the Vosges country.

Back in Paris we were able to get a more general impression of

(*Continued at foot of page* 637)

FROM ALL QUARTERS

Described by the makers as "the aerodynamic test vehicle," this aircraft (referred to below) nevertheless displays all the main features of the new anti-submarine Firefly Mark 7. A representative military load for these new duties is slung beneath the wings.

A New Mark of Firefly

ALTHOUGH the Fairey 17 has already been selected and ordered to help meet the Navy's anti-submarine requirements it will be many months before these new Double-Mamba-powered three-seaters can be built and go into service. In the meantime, therefore, still another mark of the versatile Fairey Firefly has been produced, and the prototype made its first flight last week.

The Mk 7, as this new version is called, is a three-seater. In the accompanying illustration will be noted several features which clearly distinguish it from previous marks. For example, the Rolls-Royce Griffon power plant, with nose radiator, resembles that of the Barracuda 5, while the wings are of the elliptical, full-span, rounded-tip type as fitted to the Firefly 1. The wing radiators as found on the Mks 4, 5 and 6 are, of course, absent, and a completely new feature is the blister enclosure over the rear two-seat cockpit.

For the time being security prevents the disclosure of performance figures and details of equipment, but an official statement says that the Mk 7 has radio and radar appropriate for the latest anti-submarine detection devices and sonobuoys for tracking a target at sea. No guns are carried. The Mk 7 is, of course, fully equipped for carrier operations by day or night. Dimensions are: wing span, 44ft 6in (13.6m); length, 37ft 11in (11.56m); height, tail down, 14ft 4in (4.37m).

Lord Pakenham as First Lord

FOLLOWING the retirement, on the grounds of ill-health, of Lord Hall from the post of First Lord of the Admiralty, the King has approved the appointment of Lord Pakenham as his successor. Lord Pakenham, who is 45 years of age, is Minister of Civil Aviation, a post which he has held since June, 1948. In his new appointment he will be a Minister of Cabinet rank, but will not actually be a member of the Cabinet. His salary of £5,000 a year will remain unchanged. He has held office in the Government since 1946, the year in which he was raised to the peerage. Previous to his M.C.A. appointment he had been Chancellor of the Duchy of Lancaster.

Lord Pakenham

The choice of Lord Pakenham as First Lord is an interesting one, and is being generally taken as reflecting the increasing importance of air power in Naval operations. Certainly the Minister must have accumulated a good deal of useful knowledge of air affairs in general during the past three years; his interest, as shown by his frequent attendance at aviation functions, has been consistently apparent. Even the extreme right-wing Press, in commenting on the appointment, has paid tribute to his imagination, initiative and willingness to receive constructive criticism.

No successor at the M.C.A. had been named up to the time of our going to press, though the name of Mr. L. J. Callaghan has been the subject of rumours in the columns of the newspapers. Other rumours have hinted at a merger of the M.C.A. with the Air Ministry and Ministry of Transport.

Death of Lincoln Ellsworth

WITH the death of Lincoln Ellsworth—in New York last Saturday, at the age of 71—the world loses another of the pioneers of the "golden age" of air exploration that followed the First World War.

His name will always be coupled with that of the great polar explorer Amundsen. In 1925, acting as navigator of a Dornier Wal flying-boat, and accompanied by a similar aircraft navigated by Amundsen, he made the first penetration of the Arctic, by aeroplane; this took him, from Spitzbergen, within 140 miles of the North Pole. Ellsworth's machine was forced down on the sea; and the crew of three transferred to Amundsen's; this in turn was forced to descend, and all six crew-members were eventually rescued, off North Cape, Spitzbergen, by a sailing vessel.

In the following year Ellsworth flew with Amundsen, and with Col. Umberto Nobile as pilot, in the 447ft semi-rigid airship *Norge*. Starting from Spitzbergen, they traversed the North Polar regions, eventually landing at Teller, Alaska, after 71 hours.

Nine years later, in 1935, he made a 2,300-mile survey flight across Antarctica in a Northrop Gamma with an Englishman, Herbert Hollick-Kenyon, as pilot. Fuel shortage forced them down, but they reached a supply-dump by sledge, and resigned themselves to a wait for rescue. After 55 days they were located by a Moth of the R.A.A.F., which had been taken into Antarctica by the British-manned research ship *Discovery II*.

Reconnaissance Meteors

A FEW more facts concerning the Gloster Meteor F.R.9 fighter reconnaissance and P.R.10 high-altitude photographic reconnaissance aircraft have now been released for publication. The Meteor F.R.9, which carries the standard fighter armament of four 20 mm guns in addition to its photographic equipment, is capable of 585 m.p.h. at sea level. The P.R.10, which has long-span wings, attains a ceiling of 47,000 ft and its rate of climb is in excess of the 7,000 ft/min of the armed versions of the Meteor. On both F.R.9 and P.R.10 the maximum fuel capacity is 795 gallons, and the P.R.10 can cover a distance of 1,380 miles and remain in the air for 3¼ hr. Rolls-Royce Derwent 8 turbojets are standard on both marks.

A Helicopter Tribute

THE late S/L. Alan Marsh (who lost his life in the Air Horse accident) was chairman of the Helicopter Association, and at the recent annual general meeting of that body the present chairman, Mr. N. J. G. Hill, made a noteworthy point in his reference to this loss.

"All forms of pioneering," he said, "seem to be accompanied by loss of human life, but I question whether any other branch of the industry can point to such a small number of lives lost in the course of development of the product as against the enormous number of lives that have happily been saved. Though I do not for one moment suggest that such skilled and experienced men as Alan Marsh and his crew have any equal, it is most heartening to hear of the wonderful record of mercy flights made by helicopters in Malaya, Indo-China and Korea, where up to the end of 1950 some 1,200 men had been lifted from the battle areas and taken behind the lines for medical attention."

After the chairman's speech—which included a concise review of helicopter progress and achievement in this country during the past year—Messrs. N. E. Rowe and L. S. Wigdortchik gave brief accounts of their recent tours in the United States, and Mr. Alan Bristow concluded with stories of his experiences of helicopter operations during the past year in Indo-China and Antarctic.

THE Social and Sporting events in the aviation calendar are fewer than in the 'thirties but happily we can still enjoy events like The Royal Aeronautical Society's Garden Party, the Continental Rallies and the National Air Races organised by the Royal Aero Club. At all events . . .

It pays to say

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Shackletons at Kinloss

LAST Tuesday, May 29th, Mr. Aidan Crawley, Under-Secretary of State for Air, was to make a dawn sortie from Kinloss, Morayshire, in an Avro Shackleton general-reconnaissance aircraft (four Rolls-Royce Griffon engines). The first Shackleton squadron is now fully operational at Kinloss.

Fairey Production Post

MR. ALAN VINES has been appointed production manager of the Fairey Aviation Co.; in this capacity he will be responsible for production at all factories and in particular for putting the Fairey 17 into production. He will be responsible to the general manager, Mr. Richard Fairey.

Mr. Vines joined the firm in September, 1934. In February, 1936, he was appointed assistant works manager at Stockport, and in January, 1940, he became works manager of the Fairey Company's Errwood Park "shadow" factory. He returned to Hayes in June, 1944, as production development engineer in charge of experimental aircraft and tooling. In February, 1947, he was appointed deputy chief engineer.

Avro Canada Flight-staff Appointments

TO assist in the flight-testing of the C.F.100, Peter R. Cope, who for the past fifteen months has been a test pilot with Armstrong Whitworth at Baginton, Coventry, has transferred to Avro Canada, another member company of the Hawker Siddeley Group. Much of Mr. Cope's test-flying experience has been on Mk 8 and Mk 11 Meteors, but he has more than fifty aircraft in his logbook and a total of nearly 2,000 hours. He passed through the Empire Test Pilots' School at Cranfield in 1946-7 and, while holding a short-term commission with the R.C.A.F., worked with experimental flight sections at Farnborough. During the war he served with an R.A.F. Mustang squadron. Born in England in 1921, he is married and holds a London B.Sc.

Another appointment of a British-born (Edinburgh) pilot is also announced by Avro Canada. Mr. Sydney Howland, who has comparatively wide experience in the aircraft industry, has taken on the duties of flight analyst and staff pilot. Trained by the R.C.A.F. during the war, and at present a member of the Royal Canadian Naval Reserve, he has some 2,500 hours, including recent experience as co-pilot on the Jetliner.

Insurance Exhibitions

LAST week, in a reference to two Festival of Britain exhibitions in London, both concerned with insurance, it should have been made clear that the British Insurance Association's contribution is to be viewed at the Royal Exchange, while "Two Centuries and a Half of Lloyds"—enabling visitors to see what Lloyds Coffee House looked like and to examine many relics from Lloyds archives—is at Lloyds in Leadenhall Street.

Soundness of the Brabazon Conception

SPEAKING at last week's annual general meeting of the Bristol Aeroplane Co., Ltd., Sir William G. Verdon Smith (chairman) remarked, *inter alia*, that the publicity which the Brabazon project had attracted had given it an importance out of proportion to its place in the firm's business as a whole, and that it was desirable that the firm should restate its attitude to the project. Whether the project would succeed, he continued, time alone would show. In these circumstances no operator was—nor could reasonably have been—placed under immediate obligation to order a fleet of Brabazons or undertake to operate them. The period of experiment was by no means over. It would have been encouraging had operators felt by this time inclined to commit themselves; but they had not done so. Nothing had so far occurred, however, to throw doubt on the soundness of the original conception. The ultimate adoption of the type would depend in part on the firm's skill and determination, in part on the courage and vision of potential operators, and in part, perhaps, on the conflicting claims of civil aviation and defence.

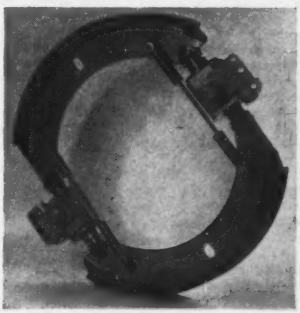
Discussing other Bristol developments, the chairman said that the Olympus turbojet had made a most promising start, and they hoped to see production in quantities which would make a major Anglo-American contribution to the defence programme of the western nations.

Today, said Sir William, even the smallest degree of expansion was a major undertaking and, if a firm was to be successful, the difficulties arising from prevailing conditions of industrial activity demanded new solutions. There were three critical factors—new plant, sufficient materials, increased man-power—and none of these factors was under the company's control.

Lockheed Airscrew Brake

THE high rotational inertia of the turboprop power unit, coupled with the low frictional drag of a purely rotary mechanism, has made it necessary for an airscrew brake to be incorporated in turboprop power installations, particularly those of naval aircraft. The lengthy "run-down" time of a turboprop after landing makes it difficult for the aircraft to be quickly struck down into the hangar, whilst the windmilling of the airscrews in the wind over the deck when the aircraft are parked is an untoward risk for the flight deck crews.

To this end, Armstrong Siddeley Motors, Ltd., and the Lockheed Hydraulic Brake Co., Ltd., have collaborated in the design of an airscrew brake for the Python, Mamba and Double Mamba turboprops. The brakes are of light alloy, and are hydraulically actuated in an essentially similar fashion to the famous Lockheed brakes used on so many cars, but differ from the car brakes in that they are of two-trailing-shoe type and have linings of a material suitable for operation when totally immersed in oil at high temperature.



The new Lockheed airscrew brake.

Operation of the brake is tied in with the engine isolator control so that, when the engine is shut down, the airscrew is not only automatically feathered, but the brake is also applied: a stopping time of under 15 seconds is achieved. An accumulator is embodied in the system to serve as a pressure reservoir for keeping the brake "on" in a parked aircraft. It is, however, not unlikely that a positive mechanical lock will be incorporated as the ultimate means of holding the airscrew stationary.

FORTHCOMING EVENTS

June	2.	R.N. Air Station Anthorn: Navy Day and Air Display.
June	2.	Auster Flying Club: Rally, Rearsby.
June	3.	Auster-Ragosine Homing Trophy, Rearsby.
June	6-16.	British Plastics Exhibition, Olympia.
June	6-23.	Royal Tournament, Earls Court.
June	8-10.	Air Circuit of Sicily.
June	8-15.	Spanish International Rally.
June	9.	Rally and Race, Fairwood Common Aerodrome, Swansea.
June	9-10.	Royal Air Forces Association: Annual Conference, Torquay.
June	10.	Lancashire Aero Club: "At Home" (sponsored by A.B.A.C.).
June	15-18.	Royal Danish Aero Club: International Rally.
June	15-July 1.	Paris Aero Show.
June	23.	R.Ae.C.: Festival of Britain National Air Races, Hatfield.
June	24.	International Rally, Pisa, Italy.
June	24.	Northern Heights Model Flying Club: Gala Day, Hawker Airfield, Langley.
June	27-28.	Institute of the Aeronautical Sciences: Annual Summer Meeting, Los Angeles.
June	30-July 1.	Cognac International Rally, France.
June	30-July 2.	Ae.C.: Members' Deauville Rally.
July	1.	International Rally, Savona, Italy.
July	4-11.	F.A.I. Committee Meetings, Brussels.
July	7.	Aero-Club de Savoie: International Rally, Aix-les-Bains, France.

EXERCISE OMBRELLE

(Continued from page 635)

the day's activities. B-50s, as we had already learned first-hand, had operated from England during the morning and were followed at intervals by R.A.F. Mosquitoes and Wellingtons and by C-82 Packets of the U.S.A.F. in Germany. What we did not know was that, after picking up their fighter escort, the Superforts had approached Western Europe from several directions to attack targets in Belgium, France and Holland. Medium bombers (presumably the "Mossies" and "Wimpeys") made diversionary attacks. Weather had been fine over most of the area, though cloud in some areas favoured the bombers. All attacking formations were claimed to have been successfully identified, and with few exceptions the bombers were intercepted and brought to battle. Though it was admitted that the work of the defending forces was "complicated" by low flying attacks on airfields and defence installations, it was asserted that, had anti-aircraft guns been deployed, these might have inflicted heavy casualties.

And so the Ombrelle was lowered and furled until 0900 hr on May 24th.

(*To be concluded next week.*)

HERE AND THERE

LIGHTER-THAN-AIR: As reported on this page ("Britain's Little Airship"), the Airship Club's 45,000 cu ft non-rigid is ready to fly. The envelope and car are seen here at Cardington.

Atar-Ouragan at Le Bourget

IT is hoped that an Ouragan fighter fitted with a French S.N.E.C.M.A. Atar turbojet will be ready in time to make an appearance in the flying display which, marking the end of the Paris Exhibition, is to take place at Le Bourget on July 1st.

Yorkshire Coast Exhibition

OPENING at the end of this month, there is to be an aeronautical exhibition at Scarborough which, housed in two blister hangars, will illustrate aviation history from the earliest times. Blackburn and General Aircraft, Ltd., are co-operating.

Busy Comet

RETURNING home from its flight to the Middle East last week (see p. 654), the de Havilland Comet made a two-hour stop at Nicosia airport, Cyprus, where it was inspected by the Governor. On its flight from Cairo to Cyprus it had cruised for a while at 37,000 ft. Today or tomorrow it is due to take off from London again for Egypt, and may call at Milan and Rome.

Air-operated Actuator

PRODUCTION of a small experimental compressed-air motor for operating aircraft ancillary services is described in the June issue of our sister-journal, *Aircraft Production*. Its air supply would probably be tapped from a cabin-supercharging system, and at 8.9 lb/sq in the two Roots-type rotors revolve at 4,000 r.p.m., developing 0.10 h.p. The Wade Engineering Co., Ltd., Gatwick Airport, are the makers.

Britain's Little Airship

AS we go to press, the British-built airship *Bournemouth*—the first dirigible to be constructed in this country since 1930—is expected to make its maiden flight from R.A.F. Station Cardington at any moment. The property of the Airship Club, formed by Lord Ventry, the craft is a small "blimp" of 45,000 cu ft capacity and 108ft overall length, propelled by a 75 h.p. British Salmson engine driving a pusher airscrew. A detailed description appeared in *Flight* of November 16th last.

Employment in the Industry

ACCORDING to figures quoted by the S.B.A.C., employment in Britain's aircraft manufacturing and repairing industry rose by a further 2,200 last February to 155,300 at the end of that month. Since the beginning of the Korean war the labour force has increased by nearly 10,000. There has also, of course, been a corresponding drop in unemployment within the industry: whereas during the first half of 1950 nearly 2,000 aircraft workers were unemployed, that figure was nearly halved by the end of March this year.

HOLLAND'S JET TRAINER: A fortnight ago we published a picture of the new Fokker S.14 side-by-side jet trainer (R-R Derwent). It has since made its first flight at Schiphol, in the hands of Capt. Sonderman—when this photograph was taken. On a second trip, an undercarriage failure occurred, but little damage was done.

Bristol's Race

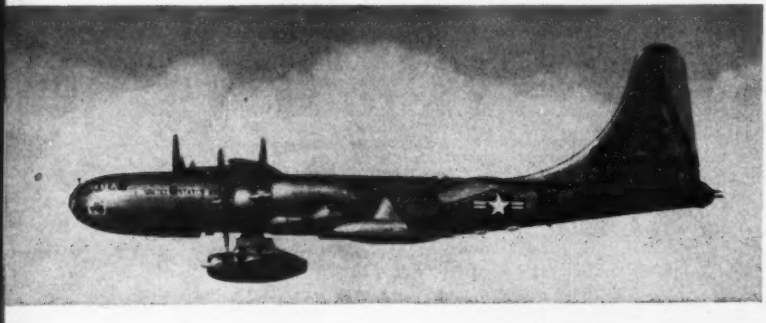
FOR the air race at Whitchurch on July 14th, Bristol Corporation has donated £200 in prize money, the Bristol and Wessex Aero Club is offering the Avian Challenge Trophy, and the *Daily Express* is giving a £25 prize. Open to any piston-engined aircraft of up to 10,000 lb. a.u.w., the contest will be flown over three laps of a 30-mile course. Full details and entry forms (entries close June 30th) are obtainable from the Town Clerk, Council House, Bristol.

Malayan Airfield Improvements

TO make them suitable for operation of jet fighters and heavy transport aircraft, airfields at Kuala Lumpur and Butterworth are being extended and relaid. A report from Singapore giving this information also mentions an estimated cost for the work of £1,880,000 sterling.

U.S.A.F. One-man Helicopter

NEWS has been received of the placing of an order by the United States Air Force for a small "jet-powered collapsible helicopter". It seems that the intention is to carry the machine folded aboard a jeep; it might also be possible to parachute such a helicopter, along with airborne troops, during an assault. Although the type is not named, a brief description of its characteristics—two small ramjets at the blade-tips; room for one man and radio; simplicity such that two men using ordinary tools could prepare it for flight—suggests that it is the Hiller Hornet (*see Flight* of Feb. 23rd).



SOMETHING NEW in flying test-beds: the powerful axial-flow P. and W. J-57 Turbo-Wasp is taken aloft for development-testing in a B-50. The turbojet nacelle retracts into the bomb-bay.

Sorry, Wrong Airfield

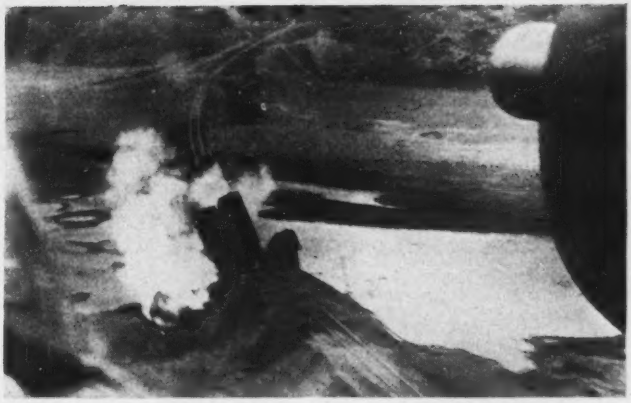
RAIN-HEAVY clouds hung over Tegel airfield, in the French sector of Berlin, a few weeks ago. An unidentified aircraft was picked up on the airfield radar and suddenly a Russian Mig-15 dropped out of the clouds, circled, touched down on the runway and began to taxi in. A marshaller beckoned; the chocks were ready; and then, as the marshaller gave the "engine cut" signal, the Russian pilot realized his predicament. He opened up, swung the Mig through 90 deg, and roared off back into the heavy clouds. This story, from *Aviation Week*, recalls one or two similar instances in England during the war—in which, however, the German pilots were less lucky.

Weight-Lifter

CLAIMED as heavier than the load of any other aircraft, 42½ tons of cargo have been flown 2,600 miles from Sacramento, California, to Savannah, Georgia, in a Convair C-99 of the U.S.A.F. The C-99, which is the transport version of the B-36 bomber, has carried over 45 tons on shorter flights and, with the addition of four turbo-jets to the six Wasp Major piston-engines, should carry even more.

Fair Oaks at Home

FOR tomorrow, June 2nd, the Fair Oaks Aero Club have organized a display and "at home" at their airfield at Chobham, near Woking. No. 18 Reserve Flying School, the Fair Oaks Club and the London Transport Sports Association Flying Club will participate in the flying display, which will begin as soon as Reserve training ceases for the day, at 5.30 p.m. Later there will be a party and dance in the mess.



TERMINUS: This remarkable action picture was taken from a U.S.A.F. 5th Air Force B-26 in Korea just as a Communist supply-train emerged from a tunnel (in background) and plunged into the river from a bridge bombed a moment earlier.

JACK-IN-THE-BOX: Semi-static test of a Northrop ejector seat with 150-lb dummy pilot. It has been fired from the 1,100 m.p.h. rocket-propelled test-sled—described in "Flight" a year ago—at Edwards (formerly Muroc) Air Force Base.

New Canadians

AT least three new Canadian aircraft are in the planning or prototype stage, according to reports quoted by our Canadian contemporary, *Aircraft*. Mention is made of an advanced fighter, the prototype of which is nearing completion at Avro Canada's Malton plant; preliminary design work by Canadair on a twin-engined transition trainer which might be powered by recipocrating, turbojet or turboprop units; and —at the works of the Canadian Car and Foundry Co., Ltd.—a new version of the Norseman, single-engined, high-wing transport, with a slightly larger fuselage and an all-metal wing.

The Two Jacquelines

IN a statement in Lisbon recently, Miss Jacqueline Cochran claimed that Mlle. Jacqueline Auriol had not, in fact, beaten her speed record, because the Frenchwoman had flown a jet aircraft (Jacqueline C. did 468 m.p.h. in a P-51 in 1947; Jacqueline A. flew a French-built Nene-Vampire at 508.8 m.p.h. three weeks ago). As categories stand at present, however, it seems that the honour does go to the French President's daughter-in-law, because there is no jet sub-division of women's records. Whether the F.A.I. will now create one remains to be seen.

IN BRIEF

THE first 50 production examples of a new jet fighter will be fitted with the type P.T.C./D.H. Venner ignition switch (recently illustrated in this column) for their booster circuits.

* * *

Rubber-to-metal-bonded clips for piping and cables are described in a leaflet from Howard Clayton-Wright, Ltd., Wellesbourne, Warwickshire. One type embodies a metal tongue to provide electrical contact.

* * *

Since last week's "In the Air" description of the Fokker S.13 two-engine trainer was published a slight improvement in estimated figures for take-off and landing run has been established. The take-off run is now quoted as 920ft and the landing run as 740ft. Both figures are given for conditions of full load on hard surfaces with a 5.5 m.p.h. headwind blowing.

* * *

Rolls-Royce, Ltd., point out that the specific fuel consumption of the Dart turboprop given as 1.005 lb/s.h.p/hr in the "Current British Gas Turbines" data table in the May 11th issue should, in fact, be 0.90 lb/s.h.p/hr. Maximum continuous rating is 1,120 s.h.p.

* * *

The Pulsometer Engineering Co., Ltd., Reading — manufacturers of pumping equipment (including aircraft fuel and vacuum pumps) and refrigerating and filtration equipment—have acquired the total share capital of Joseph Evans and Sons, Wolverhampton, who have been pump makers since 1810. Each organization will continue independent production.

BLAZING AWAY: Relevant to issues raised in Part II of Mr. K. W. Gatland's current series of articles on guided-missile evolution, this picture of a Skyraider firing spin-stabilized rockets from launchers buried within the wings is of particular interest.

GOODYEAR TROPHY

Enjoyable Racing and Display at Wolverhampton

Dunkerley with trophy and replica. He hoodwinked the handicappers with K. E. Millard's Miles M.28 (Cirrus Major).

FOR the first of the major air races of this Festival of Britain year, the weather at Wolverhampton last Saturday was ideal. Ideal for racing, that is: a general occlusion with a fairly high cloud base made it a grey day, but with a light, easterly wind and visibility not less than six miles, the conditions for pilots were excellent.

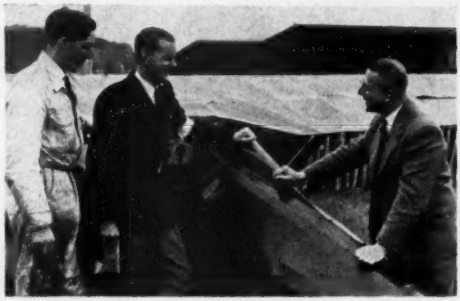
The afternoon's events opened with a formation fly-past by four Tiger Moths of No. 25 R.F.S., Wolverhampton, after which Ben Gunn, chief test pilot of Boulton Paul Aircraft, Ltd., demonstrated the agility of a Mk T2 Balliol with a nice display. Ranald Porteus, chief test pilot of Auster Aircraft, Ltd., flew an Autocrat with Goodyear castoring undercarriage, and not only flew the aircraft in the air, but literally flew it on the ground in the markedly neat and polished manner he has made peculiarly his own. Thereafter Jim Starkey, chief test pilot of Armstrong Siddeleys, made some impressive passes in front of the crowd in the Lancastrian flying test-bed with Sapphire turbojets in the outboard nacelles.

As the Sapphire-Lancastrian flew away, all eyes were upon an Auster from which Major T. Willans shortly after descended by parachute. The Major having safely and successfully landed, F/L. Gibbons in a Meteor 7 of the Central Flying School, Little Rissington, arrived (from Shawbury) to give a display of aerobatics, one of the most unusual features of which was that the whole performance was carried out at markedly low speed. It finished, however, with a rapid low transit across the field at 550 m.p.h. As the Meteor vanished from sight, a green Very was fired from Control to give clearance for the start of the Goodyear Trophy Race.

With a time allowance of 17 min, 8 sec, W. H. Creber, the limit man, was flagged away in his Autocrat, followed 30 sec later by E. F. Wild, D. Everall and W. A. Bower, in similar aircraft; the fifth Autocrat (R. A. Walley) took-off 55 sec after the first man away. Thereafter, came a gap of 3 min, 55 sec, before L. E. Mason in a Hawk Trainer III took off to start the more or less regular sequence of starts down to S/L. J. Rush (Falcon Six) at scratch.

As Rush got airborne, the first four Austers were just completing their first lap. Next to appear was Cole's Comper Swift, which passed Mason in the Hawk Trainer just before the turning pylon. As these two fled away, D. C. Jemmett's Hawk Trainer, R. R. Paine's Hawk Trainer and T. W. Hayhow's Aiglet appeared, followed by W. P. Bowles who, at about 800ft, was flying his Messenger 2a a good deal higher than most. J. C. Cairns was next round in the Monarch, closely followed by M. A. Smith in *Flight*'s Gemini. D. J. Jemmett (Proctor I) just got round the pylon ahead of F. Dunkerley's Mercury, which actually passed A. E. H. Coltman's Hawk Major in the turn. H. ("Timber") Wood entered his second lap about a mile ahead of I. A. Forbes in the Nighthawk, who was followed by Rush in the Falcon Six very quickly indeed but making more of a turn than was actually required.

At the end of the second lap, the order was as follows: Creber's Autocrat, Everall's Autocrat, Cole (Comper Swift), passing Wild's autocrat in the turn, Walley (Autocrat), Bower (Autocrat), then Mason in the Hawk Trainer, closely followed by R. R. Paine in a similar aircraft, and D. C. Jemmett in another of the same kind. As this bunch went away, Dunkerley came in very fast to pass Hayhow in the Aiglet just before the turn, whilst D. J. Jemmett's Proctor had a narrow margin over the Editor in our Gemini. Wood's Proctor led from Bowles' Messenger, whilst Cairns (Monarch) managed to get round the turn just ahead of Forbes' Nighthawk, and Rush turned inside Coltman's Hawk Major.



Cheerful group of winners immediately after the race: (l. to r.) Tony Cole (2nd), with his Comper Swift, Ron Paine (3rd), and Dunkerley (1st).

All competitors having entered the last lap, the white caravan which had acted as the turn marker moved up the field, trailing an enormous Goodyear flag, to take up a position opposite the clubhouse to define the finishing line. It was fairly evident that it was going to be a pretty close thing between Dunkerley and Cole, and so it proved. The first aircraft to be sighted was the little Comper Swift but, as it approached, the cream Mercury could be seen coming up rapidly astern; and it was as late as when passing over the railway and canal at the western boundary of the field that Dunkerley passed the Swift to take first place. Third man home was Paine in the Hawk Trainer, leading an absolute gaggle of aircraft, all pressing on low down over the trees defining the horizon. The winner's speed was 161 m.p.h., and the fastest lap was put in by Rush in the Falcon Six at 174.5 m.p.h.

It was unfortunate that the met. report of a charged atmosphere prevented a display by parachute drops by members of the 18th Battalion Parachute Regiment (T.A.); but, after the Mayoress of Wolverhampton (Mrs. James Beattie) had presented the Goodyear Trophy to Dunkerley, a simulated emergency operation was demonstrated, a stretcher case and attendant being transferred from a road ambulance to the Chrislea Skyjeep ambulance, flown by D. Lowry. The programme ended with polished aerobatics in a Tiger Moth by W. H. Creber.

GOODYEAR RESULTS

Order	Reg.	Pilot	Aircraft and Engine	Speed (m.p.h.)
1	G-AHAA	F. Dunkerley	Mercury (Cirrus Maj. III)	161
2	G-ABUS	A. L. Cole	Comper Swift (Pobjoy R)	131
3	G-AKMN	R. R. Paine	Hawk Trainer (Gipsy Maj. 1)	136
4	G-AGWT	I. A. Forbes	Nighthawk (Gipsy Six II)	165
5	G-AHNV	L. E. Mason	Hawk Trainer (Gipsy Maj. I)	126½
6	G-AHVG	H. Wood	Proctor I (Gipsy Queen II)	152
7	G-AHUX	D. J. Jemmett	Proctor I (Gipsy Queen II)	149
8	G-AGVN	W. H. Creber	Autocrat (Cirrus Min. II)	113½
9	G-AKPE	D. C. Jemmett	Hawk Trainer (Gipsy Maj. Ic)	129½
10	G-AECC	S/L. J. Rush	Falcon Six (Gipsy Six I)	170½
11	G-AJPX	E. F. Wild	Autocrat (Cirrus Min. II)	113½
12	G-AFLT	W/C. M. A. Smith	Gemini (2 Cirrus Min. II)	139
13	G-AHST	D. Everall	Autocrat (Cirrus Min. II)	112½
14	G-AHAO	R. A. Walley	Autocrat (Cirrus Min. II)	113
15	G-AMIH	T. W. Hayhow	Aiglet (Gipsy Maj. I)	126½
16	G-AIGH	W. A. Bower	Autocrat (Cirrus Min. II)	110½
17	G-AFCR	J. C. Cairns	Monarch (Gipsy Maj. I)	126
18	G-AJYZ	W. P. Bowles	Messenger 2a (Cirrus Maj. III)	121½
19	G-ADMW	A. E. H. Coltman	Hawk Major (Gipsy Maj. I)	127

"Flight" photographs

Three Autocrats, Nos. 6, 5 and 8, move off together thirty seconds after the limit man, as the starter, Mr. Phillip Mayne, again drops his green flag.

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Part I: The History of Scandinavian Air Transport: Growth of Trilateral Co-operation

By E. A. G. RUMBELOW

PERHAPS because our one-time Viking conquerors have stronger roots in Britain than we had realized, perhaps merely because we cannot help but admire the good-humour and logic with which their modern descendants greet everyday problems—whatever the reason, it is certain that the Scandinavian peoples have for us a greater affinity than has any other European nation. Oddly enough, most other races hold a similar opinion, which leads us, therefore, to favour the second explanation for the phenomenon.

Certainly, this sound, commonsense attitude towards life is one of the most striking characteristics of the Scandinavians and its continued application throughout the past few centuries has enabled the peoples of Denmark, Norway and Sweden to overcome national prejudice and effect a degree of international co-operation which is quite remarkable in its extent. Today, the benefits of this policy can never be more clearly seen than in the approach which the three countries have adopted to the highly competitive business of civil air transport. The Scandinavian Airlines System has emerged as a fine example of what can be done by rational thinking.

As long ago as 1939 the national airlines of Sweden, Norway and Denmark had begun negotiations to establish a common airline to North America. At the beginning of 1940 negotiations were taking place between the Scandinavian postal authorities, the airlines and the United States to inaugurate such a route in conjunction with Pan American Airways. The invasion of Norway and Denmark curtailed this plan—but not for long. The Swedish company, A.B.A., which had played the leading role in devising the earlier scheme, embarked upon the task of establishing joint operations for the future. No financial help was forthcoming from the Swedish Government at that time and so the project was left entirely to private enterprise. After lengthy negotiations the Swedish Intercontinental Airlines (S.I.L.A.) were formed to operate all Swedish intercontinental traffic. A.B.A. was to continue to run European traffic and it was also agreed that they should share with S.I.L.A. any technical or administrative facilities which were required.

Despite the obstacles imposed by war, negotiations were begun with the Danish and Norwegian airlines. It was quickly agreed that co-operation between the Scandinavian countries was essential for full economy and that as soon as the war had ended an early start should be made to implement such a plan.

In 1946 the three countries decided to pool their resources for international traffic under the title of S.A.S. The benefits of this venture proved so far-reaching that now, in 1951, the far-sighted Scandinavians have been able to realize their long-standing ambition—a consortium agreement which completely merges all participating national airlines for all types of traffic and eliminates all competition between the three countries. Although foreign observers have cautiously called this experiment "an encouraging example of how

Present History: Signing the agreement which provides for the complete merger of the three S.A.S. airlines are (seated, left to right) M. Wallenburg (Sweden), Per M. Hansson (Norway) and Per Kampmann (Denmark). (Standing) Axel Gjöres (Sweden), Einar Isdahl (Norway) and Prince Axel (Denmark). (Right) Past History: A notable Scandinavian first flight, from Lindäräangen, on June 2nd, 1924, in a Junkers F.13 belonging to A.B.A., the Swedish partner in the Scandinavian Airlines System.

Typical of the glorious scenery which attracts so many tourists to Scandinavia is this view of Mount Kebnekaise, taken at 0030 hours.

IN THE WAY OF THE VIKINGS . . .

small countries can join together for the common good," the new agreement represents far more than an ideal. It is, in fact, a definite answer to the challenge of growing competition in the field of international air transport; it is also of the greatest interest in view of the call for airline co-operation on a European basis made by Count Sforza, of Italy, at a recent meeting of Ministers of the Council of Europe. In the coming years, it may well be that S.A.S. methods will form the pattern for similar arrangements among at least the smaller countries of the world whose geographical location renders such a plan feasible.

With these thoughts in mind I recently took the opportunity to visit Scandinavia with the object of gaining first-hand knowledge of how the S.A.S. plan is being put into practice. In the course of a week I was able to call at the three main airports of Kastrup (Copenhagen), Bromma (Stockholm) and Fornebu (Oslo), and to see something of the S.A.S. operations and maintenance organizations. It was a tour that left a deep impression of the streamlined efficiency and simplicity of the new set-up. The organization is young, but by no means lacking in experience, and the heartening spirit of comradeship and industry observable amongst the personnel throughout the system holds promise of an unprecedented airline success-story. Before recording personal impressions, however, it may be useful to go briefly into the history of aviation in the three countries, in order to appreciate more readily the position which has been reached today.

Denmark.—The Scandinavians are no newcomers to aviation. The Danish partner in S.A.S., Det Danske Luftfartselskab, has some claim to be the oldest airline in the world, for it was founded by the sculptor Willie Wulff on October 29th, 1918, though its first regular route (flown from Copenhagen to Warnemünde, with a Friedrichshafen hydroplane) was not inaugurated until August 7th, 1920. Later in the same year a route to Hamburg was opened with a de Havilland D.H.9. In that year, also, the company participated in the North-West European service (which included a Copenhagen-Amsterdam-London route) operated by British, Dutch, Swedish, Danish and German interests. In 1937 control of D.D.L. passed from the State into private hands, the State and the Copenhagen municipality retaining, however, 17 per cent of the capital of 30,000,000 Danish crowns.

The Copenhagen airport of Kastrup had been opened in 1925, when services were operated daily to Berlin, Hamburg and Amsterdam. A small hangar and an unimposing administration building had been erected, but soon proved totally inadequate for the rapidly increasing traffic. When Denmark was occupied at the beginning of the second world war, most of the company's activities were brought to an abrupt halt, but war-time routes were later opened to the isolated island of Börnholm in the Baltic, to Malmö and to Berlin, Munich and Vienna. Large-scale expansion did not take place until the end of the German occupation, when D.N.L. became a partner of S.A.S. in August 1946, with a two-sevenths participation in the total resources.

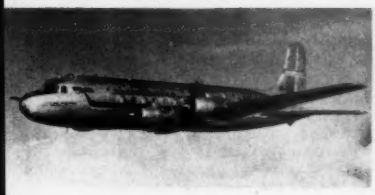
Sweden.—The first Swedish company, established in February 1919, was the Svenska Lufttrafikbolaget. Operations began in 1920 to Estonia and Germany, and for a short period there were also two other Swedish companies in existence. The present A.B.A. did not begin life until June, 1924, when it was founded—entirely on private capital—by Capt. Carl Florman. It was the first airline to use three-engined, all-metal aircraft for passenger services (Junkers, introduced in 1937). The first passenger flight was made on June 2nd between Stockholm and Helsinki, with a Junkers F.13 floatplane, as shown on p. 641). In 1939 the network had extended to a number of European capitals and included a route to Moscow on which traffic was pooled with Aeroflot. A.B.A. was also the second European airline to purchase American aircraft of the DC-3 type.

At the outbreak of World War II most of the routes had to be withdrawn but of those remaining probably the most interesting was the so-called courier link with England. It was maintained by A.B.A., the R.A.F. and, later, by the American M.A.T.S. Important passengers were carried between Sweden and the Western Powers and large consignments of Swedish ball-bearings, to aid Allied war production, were flown to Britain under the very noses of the enemy. The company lost two DC-3s which were shot down during these operations.

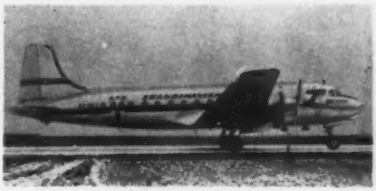
By May, 1945, A.B.A. was in a good position to cope with the increased traffic potential which peace made available. As a special concession, the United States Government permitted Sweden to take over a number of B.17s, three of

A picturesque setting in the Northern territories, which are served by the Ju 52 floatplanes.

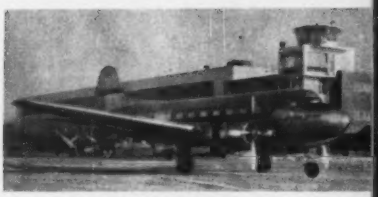
An S.A.S. Short Sandringham traverses the jagged outline of the Norwegian coast during a "midnight sun" flight.



Douglas DC-6



Douglas DC-4



Saab Scandia

TYPES IN THE S.A.S. FLEET TODAY

Douglas DC-3

Short Sandringham

Junkers Ju 52

which were converted for passenger-carrying and used on international flights. Routes were soon under way to 14 different countries and, on August 1st, 1946, the Swedish Intercontinental Airlines—later amalgamated with the A.B.A.—became a partner in S.A.S. By 1947 A.B.A.'s route network, stretching over 37,000 km, was the most extensive in Europe.

Eight of the 12 DC-6s which S.A.S. acquired in 1948 were allocated to A.B.A. who, since the end of the war, had re-equipped exclusively with Douglas aircraft.

From 1946 no State aid was considered necessary and, in fact, from 1932 to 1946 operations had been pursued profitably. In 1947, however, the purchase of new aircraft, and a strike, brought about a rather heavy loss; so, in order to strengthen Swedish civil aviation the amalgamation of A.B.A. and S.I.L.A., was brought about. After amalgamation the capital of the enterprise was increased to 50,000,000 Swedish crowns, of which the Government owned 50 per cent and S.I.L.A., representing private enterprise, the other half.

From April 18th, 1948, A.B.A. began to share all Scandinavian traffic within Europe with the other partners in S.A.S., while retaining, as did the others, the right to conduct its own internal operations.

Norway.—The first Norwegian company, Det Norske Luftfartsrederi (D.N.L.) was established in 1918 and, although the organization flew about 20,000 km, carrying mail, it was liquidated in 1920. The D.N.L. which we know today (Det Norske Luftfartselskap) was not formed until 1927, but still did not begin operations until a considerable amount of capital had been provided—by Norwegian steamship interests—in 1935. A ten-year concession was obtained to operate domestic and European schedules and in 1937 a five-year mail contract was signed with the Government.

At April 9th, 1940, the company's fleet consisted of three Ju 52s and one Ju 34W. During World War II the fleet was requisitioned by the Germans and all activities were completely curtailed. It was in London, therefore, that the plans for the post-war era had to be prepared. A Royal Norwegian Air Transport Board was established, and its proposals were accepted by the Norwegian Government in 1946. D.N.L. officially re-started operations on April 1st of that year, and in 1947 were granted, by royal decree, a 20-year concession for all domestic and international routes to and from Norway. The company's share capital at this stage was 25,250,000 Norwegian crowns, of which almost 20 per cent was subscribed by the Government. The company was controlled by an honorary board under the chairmanship of the Governor of Oslo, until, in 1948, the management was changed and the noted Arctic explorer Major General Hjalmar Riiser-Larsen became president.

The company's fleet at the beginning of January, 1950, consisted of ten DC-3s, three Sandringham Mark VI flying-boats, four Ju 52s, two DC-4s and two DC-6s. The main operational and technical base was located at Fornebu airport, near Oslo, and an extensive network of services was operated throughout Norway, in addition to the international traffic.

* * *

This, then, is the background of the three companies which represent, each in its own country, by far the greatest proportion of Scandinavia's civil aviation activity. As has already been mentioned, it was a quick realization of the fact that growing competition could only be met by the united effort which brought about early negotiations for a co-operative system. The initiative was taken, with A.B.A.'s consent, by Svensk Interkontinental Lufttrafik (S.I.L.A.) who, after 1945, pushed ahead vigorously the negotiations with Denmark and Norway.

Although the principle of co-operation was acceptable, however, its application presented more difficulty. During the war Denmark and Norway had not had Sweden's opportunities for building up an organization or for training personnel. The three parties, therefore, were not equally prepared; yet, although it might have been easier for the Swedes than for the Danes or Norwegians to enter the international field alone, it was quite clear that each had much more to gain from a combined effort. So loyal were the three companies to the idea of co-operation that plans for joint traffic went ahead as though complete agreement had been reached on all points—even when, in 1945-46, it often appeared that nothing would ever be settled.

One difficulty was to establish the form which the agreement was to take. A corporation would have to be registered with one particular nation and was, therefore, inadmissible. The enterprise had to be common to all and not bound to any one of the three countries. The answer was found in the formation of a consortium in which the three companies D.D.L., D.N.L. and S.I.L.A. participated in the proportions of Sweden three-sevenths and Norway and Denmark two-sevenths each. Revenue and expenses from the services

Freight charter has played an important part in the development of S.A.S. traffic. This DC-4 is loading at Kastrup.

IN THE WAY OF OF THE VIKINGS . . .

were divided among the participants in proportion to their holdings, while at the same time each company contributed aircraft, equipment and the required amount of capital. The companies chartered their aircraft to S.A.S., which had its own organization and personnel in Stockholm and was headed by a board of directors consisting of two Danish, two Norwegian and two Swedish representatives. The first chairman was the director of D.D.L., Mr. Per Kampmann.

S.A.S. was empowered to negotiate bilateral agreements with other nations and was officially recognized by foreign powers. To meet foreign competition, much of which was State-subsidized, the new S.A.S. had obviously to fine down its overhead costs to the absolute minimum. This policy of streamlining when many of the other companies were still "empire-building" paid off in substantial dividends and has continued to do so up to date.

The first S.A.S. aircraft to wear the common badge incorporating the three Scandinavian flags took off for New York on August 1st, 1946. Later the same year a further route was opened to Montevideo, *via* Lisbon, Dakar, Recife and Rio de Janeiro and was later extended to Buenos Aires. Joint operations of the S.A.S. overseas division on inter-continental routes having proved successful, it was obviously out of the question to continue the competition between the three companies within Europe. D.D.L. and D.N.L. had not competed directly with S.I.L.A., which had not operated Continental routes, but they had run in competition with A.B.A., which had focused its attention on European services and had not joined the consortium. The task of ending this wasteful state of affairs was made easier when the two Swedish companies, A.B.A. and S.I.R.A., were satisfactorily merged in 1948.

The European division of S.A.S. (E.S.A.S.) was formed to co-ordinate all services excluding domestic Scandinavian flights and the two Atlantic routes, which still required a separate organization in view of their special operating problems. A joint sales system was formed which included common foreign representation, common operations and technical services and a common accounting system. Scheduled European flights were directed by a co-ordinating section, and a freight unit in Oslo supervised charter flights. This Charter Central, as it was known, had at its disposal two DC-4s and two DC-3s, which were constantly available for charter traffic. In the first eight months of 1949, for example, 350 separate charter flights were negotiated.

The joint S.A.S. fleet then numbered 70 aircraft and included 16 DC-6s, nine DC-4s, 39 DC-3s, four Vikings, two Sandringhams and two Ju 52s. Copenhagen became the maintenance base for the DC-4s at the end of 1947 and Oslo took over the maintenance of two-engined types. Meanwhile Stockholm became the permanent base for the DC-6s. By April, 1948, the total network of S.A.S. covered 149,000 km (92,603 miles) and included 69 different points in Europe, Africa, the Middle East and the Americas.

The desirable sequel was, of course, that the whole cycle of development should be completed with the application of the same co-operative principle to operations within Scandinavia. As this was logical and, at the same time, good economy, the Scandinavians were not slow to bring such an arrangement into being.

On February 8th of this year the consortium agreement was signed, under which the entire resources of the three companies were completely pooled and the former O.S.A.S. and E.S.A.S. agreements invalidated. Participation is in the same proportion as hitherto, i.e., Sweden three-sevenths and Norway and Denmark two-sevenths each and the initial capital of the consortium is set at 157,500,000 Swedish kroner. The agreement is valid until 1975 unless, under certain circumstances, it is terminated earlier.

The affairs of the enterprise are managed by a board of directors, an executive committee appointed within the board, and one or several managers, one of whom is appointed general manager or president. The president now in office is Mr. Per Norlin; the board is under the chairmanship of Mr. Per M. Hansson of D.N.L. who, together with five other directors, forms the working committee.

The S.A.S. fleet of 55 aircraft comprises 12 DC-6s, nine DC-4s, 24 DC-3s, six of the newly-introduced Saab Scandias, two Sandringhams and two Ju 52 floatplanes. Eight DC-6Bs have been ordered and are due for delivery next year. The new administrative set-up to co-ordinate the operations of the revised S.A.S. system is based at Stockholm, the three former airlines having now become holding companies with no separate activities; they are referred to as the Norwegian, Danish or Swedish divisions.

More detailed mention of some of the effects of the revised agreement, and some impressions of F.A.S. operating technique, will be contained in the second and concluding part of this article.

The Oslo seaplane base, from which the Sandringhams are operated, is conveniently near the main airport at Fornebu.

A Brief History to Date: And Possibilities Discussed by an American Authority

The first rocket-powered intercepter to be used on operations was Messerschmitt's Me 163B with Walter H.W.K.509 rocket unit. American bombers encountered this type in 1944.

The Rocket-powered Intercepter

THE past two years or so have seen a marked resuscitation of interest in pure-rocket aircraft for the defence of vital targets, though no machine of the class has been built since the war (except possibly, in Russia, where the Me 263 has been the subject of deep study). Various aspects of such aircraft—especially their armament—were discussed by Mr. Kenneth W. Gatland in the second of his articles on the "Evolution of the Guided Missile," appearing in our issue of May 18th. Pending publication of the next instalment of Mr. Gatland's survey, we believe that many readers will welcome this review of a class of aircraft which itself is akin to a piloted missile.

LIKE so many other developments now occupying the attentions of our technical planning staffs, the rocket-powered intercepter fighter was a German concept. Though prematurely realized in the stress of war (the first Me 163 target-defence intercepters were in action late in 1944), it is now seen to offer a promising solution to certain defence problems, pending the perfection of pilotless ground-to-air guided missiles. A brief survey of its history and possibilities is therefore timely.

Rocket-powered fighters built or projected in Germany were of three principal classes. First there were the non-expendable machines, typified by the Me 163, 263 and P.1104, the Heinkel Julia, and the Junkers Walli; then the semi-expendable variety, typified by the Bachem Natter; and thirdly what might be termed special-purpose fighters, e.g. a miniature air-launched Arado and a Zeppelin ramming aircraft. Only the Me 163 (sub-type B) became operational.

Basically of Lippisch design, the 163 was developed at the Messerschmitt works, though it was never favoured by Willi Messerschmitt himself; in fact, quarrels occasioned by this machine led ultimately to the estrangement of the two designers. At first it was produced as a glider (163A) and was towed behind an Me 110. A re-design, with a Walter rocket unit, became the 163B, and this was produced in some numbers and saw action against American day bomber formations in 1944. The scale of operations was, however, restricted by the bombing of rocket-fuel plants.

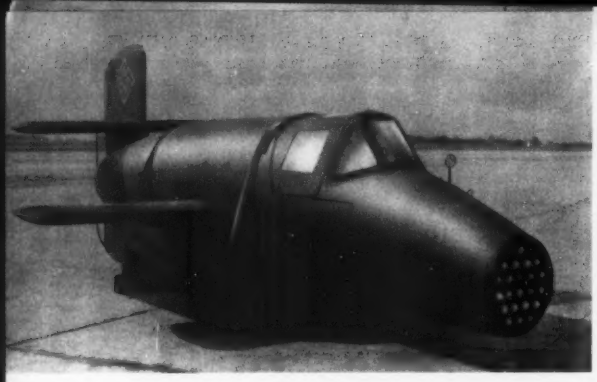
The 163B had a swept-back wooden wing with a marked wash-out of incidence towards the tips and, in addition to "elevons", had large fabric-covered trimming surfaces. The metal fuselage was made in halves, the rear portion, housing the Walter H.W.K.509 rocket, being detachable. The machine took off under its own rocket power on a twin-wheel undercarriage, which was jettisoned automatically when the landing skid between the wheels was retracted. About 226 gallons of T-Stoff (concentrated hydrogen peroxide) and 110 gallons of C-Stoff (hydrazine hydrate and alcohol) were carried in wing and fuselage tanks and weighed some 4,450 lb, accounting for nearly half the all-up weight. Two 30 mm Mk. 108 guns, with 60 rounds each, were mounted in the wing roots.

In service the 163B was limited by its aerodynamic characteristics to a speed of 550 m.p.h. Restricted fuel capacity and the lack of a pressure cabin limited the ceiling to 40,000ft, which height was attained in under 4 min. The range after climb was 22 miles at 495 m.p.h., but endurance could be protracted by periods of gliding. Even so, the Germans recognized that this performance was quite inadequate, and the H.W.K. 509C rocket, with a cruising chamber, was developed for the Me 163C to give an endurance under power of 12 min. The 163C weighed over 11,000 lb, and had a pressure cabin, permitting a ceiling of about 52,000ft.

In order to leave Messerschmitt free to concentrate on the turbojet 262 further development of the 163 was handed over to Junkers, who re-designed the 163C as the 263, with a slimmer fuselage and retractable tricycle undercarriage. It was found possible to provide tankage for about 530 gallons of fuel in eight wing and fuselage tanks.

When tenders were called for to meet a specification for a special target-defence aircraft simple in design and cheap to produce, Junkers designed the Walli, or EF 128, which had a span of only 20.6ft and weighed 6,100 lb. The sea-

An historic P.R.U. photograph, released in 1944, showing an Me 163 taking off from Zwischenahn. The rocket trail is clearly visible. (Right) The later and more efficient 263.

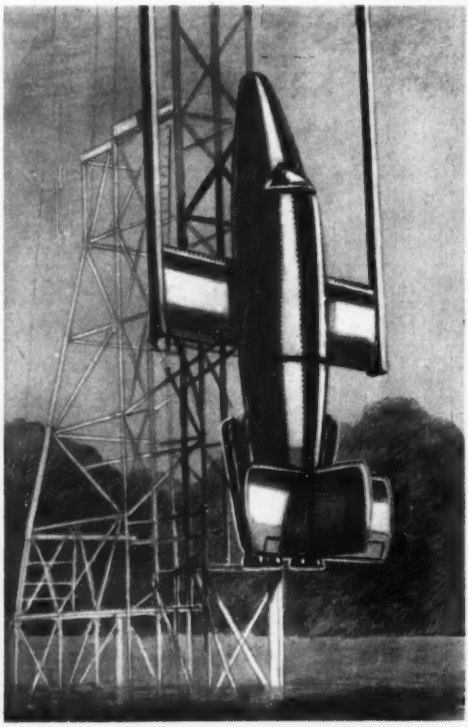


Bachem Natter semi-expendable target-defence intercepter, showing the disposition of the battery of R4M rocket projectiles in the nose. This type was designed for vertical take-off, as seen in the lower picture.

THE ROCKET-POWERED INTERCEPTER . . .

level rate of climb was to be 26,000ft/min and the endurance 9½ min. Walli was designed to take off on a tricycle undercarriage but to land on a long faired skid. The Heinkel Julia, or P.1077, was even tinier (span 15ft), but nevertheless, weighed nearly two tons. Julia was to be assisted off by four solid-fuel rockets, each delivering a thrust of 2,600 lb for 10 sec. The climb to 49,000ft was to take only 72 sec. Skid landing and a prone pilot position were foreseen. Messerschmitt's corresponding proposal, the P.1104, had a 70 sq ft wing area and a designed sea-level rate of climb of 39,000ft/min.

The Bachem Natter (BP 20B) was even less orthodox in concept, and bore closer kinship to a guided missile than to a conventional fighter. Measuring 13ft in span and weighing 4,900 lb (including four A.T.O. rockets), it was to have an initial rate of climb of over 37,000ft/min after a vertical launch from a special framework. The flight was to be directed from the ground in accordance with radar plots, and the pilot was responsible for controlling the machine for the last few hundred yards to the target and for firing a salvo of R4M rocket projectiles, or expending the ammunition from two Mk. 108 guns. His mission completed, he would jettison the rear portion of the fuselage, housing the Walter rocket, which would descend by parachute. He would then eject himself from the expendable remaining portion. As originally planned, the whole aircraft was to be expendable.



Method of launching the Bachem Natter from a special structure with the aid of four jettisonable assisted take-off rockets attached to the tail.

The deficiencies of such aircraft as those described were, of course, only too apparent to the Germans, but with characteristic ingenuity they set about marrying the liquid-fuel rocket to the turbojet fighter. This they essayed in two ways. First, taking a standard Me 262 fighter, they replaced the normal turbojets with two B.M.W. 003R combined turbojet and rocket units. The 003Rs comprised a standard 003 turbojet with a B.M.W. 718 nitric acid rocket, weighing 180 lb and delivering 275 lb thrust for 3 min, mounted at its rear end and faired into the same nacelle. A special drive was transmitted through a shaft to the rocket-fuel pumps.

The second approach to the problem of combining turbojets and rockets was again to make use of the basic Me 262 airframe, but in this instance, a single Walter bi-fuel rocket was mounted in the modified tail of the fuselage, the rudder being undercut to clear the efflux. A large proportion of the turbojet tankage was to be displaced by T- and C-Stoff, and there was to be an additional jettisonable tank for T-Stoff under the fuselage nose. The increase in flying weight from 15,500 lb to nearly 18,000 lb necessitated two auxiliary wheels, attached to stub axles and jettisoned after take-off.

There were various other projects for turbojet aircraft with auxiliary rockets, including a Focke-Wulf design almost identical with the Vampire (or perhaps, more correctly, the Venom, for it had a swept-back leading edge and straight trailing edge).

The first post-war fighter designed from the outset to use rocket power is the Republic XF-91. First flown in May, 1949, this single-seater has provision for four rocket motors in addition to a General Electric J-47 turbojet. The rockets provide extra thrust for take-off (if necessary), for climb and for closing on a target at great heights.

The Douglas D-558-2 Skyrocket transonic research aircraft is another turbojet-cum-rocket example, but the Bell X-1, credited with having attained a Mach number of 1.4, is a pure-rocket machine.

In Great Britain no aircraft is yet claimed as having flown under rocket power, though there seems to be no reason why certain existing turbojet fighters should not be adapted. The Hawker fighters with bifurcated turbojet trunks should be especially amenable for conversion. Fairey's F.D.1 delta-wing research aircraft (1 Rolls-Royce Derwent turbojet) has a cluster of four fairings in the tail, which might eventually house rocket units; in fact, a machine of just this character would appear well suited for employment as a ramp-launched intercepter, either with mixed, or pure-rocket, power.

Certain it is that the rocket is being seriously considered as a power-plant for specialized fighters, and the observations of Mr. Howard R. Moles, who, in his capacity as chief engineer to Reaction Motors, Inc., of Rockaway, New Jersey, U.S.A., is well equipped to discuss the application of rocket power to aircraft, are of particular interest at this time. Mr. Moles stated his views in a paper at the Flight Propulsion Session of the 19th annual meeting of the Institute of Aeronautical Sciences in New York earlier this year.

For many years, he said, the speed of sound had been exceeded by unmanned aircraft and by many types and configurations of missiles. The fear surrounding the "sonic wall" had largely been eliminated, or at least sufficient

investigation had been made to allow the definite statement that the design problems were not insurmountable. Man had travelled at supersonic speeds with no ill effect to his system and had been subjected to higher g loading than would be necessary in rocket-powered flight. Pressurized control cabins had been in use for many years, and the detection systems were backed by a considerable period of successful operations which would allow the rocket intercepter to operate well above the attainable altitude of conventional aircraft and still be able to detect them for a possible attack.

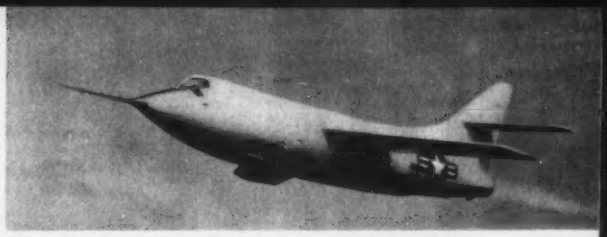
It was possible, said Mr. Moles, to develop a rocket intercepter, such as he would propose, at a relatively low cost: the problem was primarily one of applying currently available techniques and incorporating into one machine all items developed to date. The Bell X-1 and other rocket-powered types now flying could be converted to intermediate rocket-powered intercepters with a performance well in excess of existing military machines. They could carry small "warheads" and sufficient propellants for a combined climb and cruise at reduced thrust for 20-30 min, and still have fuel for a full-power 30-sec speed run. They were, however, designed primarily for flight research and would not represent the ultimate intercepter aircraft. A more advanced design would be along the following lines.

A radar antenna would be located in the nose. Directly behind this, sitting upright, would be the pilot. The controls would be of normal surface type and the entire nose could be detachable as a capsule for lowering by parachute. Behind the capsule would be a section for radio and communication equipment; then, occupying the major portion of the fuselage compartment, would be the propellant tanks. In the aft end would be the power plant, consisting of two cylinders with a total thrust of 26,000 lb. One cylinder would be a 5,000 lb thrust unit; the other of 21,000 lb thrust. In operation the smaller cylinder would be started first and then, after a stable condition had been reached, the large one would be brought into action.

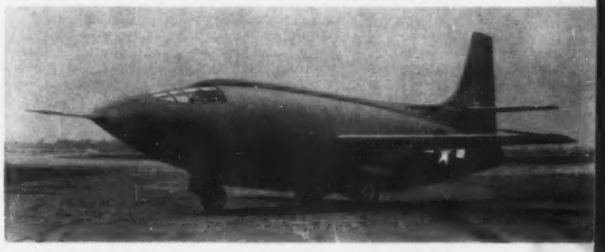
The intercepter would be launched from a special launcher operating under the machine's own power. The gear for launching would remain with the launcher and the aircraft would be equipped with skids—retractable or fixed—for landing. Alternatively, it could land on any relatively smooth water. The "warheads", estimated to total about 1,000 lb, would be carried at the wing-tips. A small independent propellant charge would be carried with each warhead to give it a velocity slightly in excess of that of the aircraft. Estimated characteristics of the intercepter would be: Gross weight, 13,000 lb; landing weight, 3,500 lb; wing area, 100 sq ft; wing span, 25ft; fuselage length, 30ft; propellants, 8,000 lb; max. speed, in excess of 2,000 m.p.h.; max. rate of climb, in excess of 50,000ft/min; ceiling, above 200,000ft; range, 140 miles.

Concerning endurance, said Mr. Moles, it had to be clearly understood that the conventional idea of endurance did not apply to rocket-powered intercepters, for they would be assigned to specific tasks. The endurance to cover a 140-mile range would be about 6 min. The tactical mission of the aircraft would be "close-in" protection of fixed bases, either on land or sea. Because the propellant load was 8,000 lb and the landing weight 3,500 lb, the buoyancy of the propellant tanks alone would cause the fuselage to float less than half submerged. The small radius of action and the short endurance indicated that the intercepter should be operated from fixed bases at key points, or from ships guarding a strategic base. A launching ramp, as illustrated, could be provided near the base, or a V.2 type of launching platform could be used. The ramp depicted could be rotated through 360 deg in a horizontal plane and could be tilted or elevated to a maximum of 90 deg for vertical launching. The majority of the launchings would be at about 45 deg, since this was the optimum climb angle.

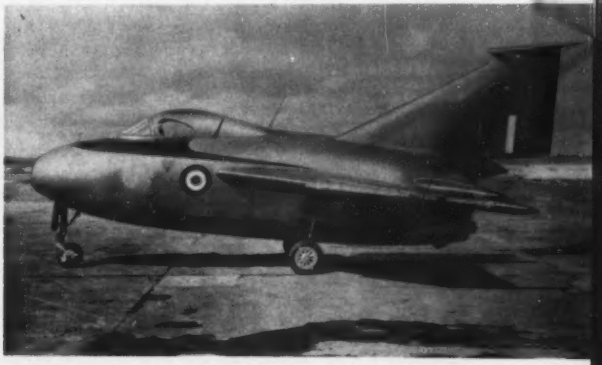
Once the position of the approaching enemy had been established, the launching ramp, with the intercepter on it, would be set to give the direction for interception. The small cylinder would be started and then the large cylinder; this would launch the machine with an acceleration of about 2g, and as the fuel was consumed in flight the acceleration would increase but would be limited to a maximum of 6g. Various methods of climb were possible. The large cylinder could be turned off and on, or it could be operated continuously,



Douglas Skyrocket turbojet-cum-rocket research aircraft developed for the U.S. Navy. The cockpit section of the fuselage is jettisonable.



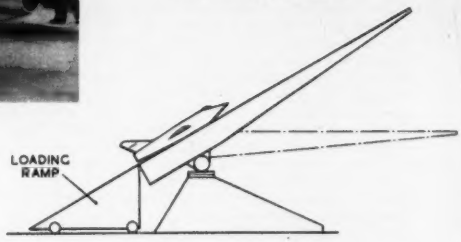
Bell XS-1—designed for research and the first aircraft to exceed sonic speed. Usually air-launched, but able to take off under its own power.



These views of the Fairey F.D.1 delta-wing research aircraft show the machine with its temporary tailplane. Visible at the rear of the fuselage are housings which might contain rocket units. Such a configuration would be suitable for a ramp-launched rocket-powered intercepter.

Republic XF-91 turbojet-cum-rocket intercepter, showing rocket installation above and below the jet tailpipe. The incidence of the inverse tapered wing is variable.

(Below) Launching and loading ramps proposed by Mr. Howard R. Moles for the rocket-powered intercepter fighter advocated by him and described in the accompanying article.



THE ROCKET-POWERED INTERCEPTER . . .

depending upon the point at which it was desired to intercept. It might be desirable to climb well above the approaching aircraft and level out to direct the warheads. The speed of the intercepter would be ample for the warheads, and it would only be necessary to supply enough additional propellant to accelerate them sufficiently for them to leave the aircraft. The intercepter's margin of performance over the approaching conventional aircraft would be so great that many new tactics would be possible.

On the question of fuel consumption, Mr. Moles admitted that the thought of using an aircraft with an even more voracious appetite had deterred many people from even considering rocket power. This attitude, however, he considered to be superficial, for the rocket intercepter must not be compared on a time basis but rather on a "per mission" basis. It would be dispatched only when interception was possible and proper tactical usage might actually permit a considerable reduction in support requirements. Comparison with other types must be made on a fundamental basis—i.e. cost to the operator versus cost to the enemy, including all phases of the operation from factory to the final consequences of combat. For example, the comparison on the basis of gross weight would be completely misleading. Initial cost, one of the major elements of the total cost, was most accurately based on empty weight.

Many tactical uses of new weapons were conceived by the forces in the field rather than by those responsible for the initial development, and rocket-powered aircraft possessed such unusual characteristics that service tests might reveal uses not yet foreseeable.

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THE ADASTRAL PLAYERS

RECENTLY the Adastral Players gave three performances of J. B. Priestley's two-act play, *The Linden Tree*. The acting was worthy of the high standard this company of Air Ministry and M.C.A. enthusiasts have set themselves in the past. Casting was excellent, and W. G. Clements, in the principal part of the stubborn but wise Professor Linden, received well-deserved rounds of personal applause.

It would be invidious to single out all those in the cast who played the other members of the Linden family, but Dorothy Henzell as Mrs. Linden, and Dorothy Ledamun, as the youngest daughter, were particularly assured. Comic relief was introduced by the Cockney housekeeper, played with bravura by Sheila Buchanan. The play, pervaded as it is with Mr. Priestley's particular brand of aggressive nostalgia, requires considerable skill on the part of all the members of the cast, but more than anything else it demands complete understanding from the producer, and in this task Arthur Beckess did not fail. The orchestra of the Central Band of the Royal Air Force, conducted by W/C. A. E. Sims, provided incidental music.

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GAS-TURBINE RESEARCH

A Lecture by the Director of the National Gas Turbine Establishment

UNDER the auspices of the British Council, a series of lectures was recently delivered in Austria by Mr. Hayne Constant, C.B.E., M.A., F.R.S., F.R.Ae.S., M.I.Mech.E. He addressed the Austrian Society of Civil Engineers, and also Technische Hochschule audiences in Vienna and Graz. His subjects were "General Progress in Gas Turbines," "Aircraft Gas Turbines" and "Gas-turbine Research." As the one most likely to be of general interest to our readers, the third of Mr. Constant's lectures is reproduced below. A few passages concerned essentially with industrial gas-turbines and the use of low-grade residual fuels have been omitted.

THE constant-pressure gas-turbine power plant, unlike the reciprocating engine, has proved to be very amenable to the research approach. It can be split up into its components—compressors, turbines, heat exchangers, combustion chambers and coolers—and each part can be studied separately. The flow of working fluid is continuous and is not subjected to the violent fluctuations that occur in the piston engine. As a result of this and of the absence of reciprocating motion, the stresses in most parts of the machine are nearly steady and the only serious vibrations are usually confined to the actual blading. In a well-designed machine the flow of working fluid is reasonably under control, so the laws of fluid flow can be directly applied. The whole power plant provides a great contrast to the reciprocating engine, in which the intermittent nature of the cycle and the violent fluctuations in pressures and stresses combine to give a process so complex that analysis can be made only with the greatest difficulty.

In the gas turbine each component and, to some extent, the separate parts of each component, can be studied separately and the factors determining its performance can be measured and assessed. The most vital of these parts is probably the blading. The study of blading for both compressors and turbines is based on airflow tests in wind tunnels. By blowing air through a wind tunnel, in which is mounted the row of blades in which we are interested, we can measure the decrease in the total head of the air caused by the blade losses, the deflection of the air, the secondary flow induced by the ends of the blades and the actual forces on the blades. The conditions occurring in an actual compressor or turbine are, of course, not identical with those in a wind tunnel, and corrections have to be made for three-dimensional and other effects before the performance of a single-stage compressor or turbine can be deduced from the wind-tunnel measurements. The wind tunnel is, in spite of this, an indispensable tool, for the speed at which results can be obtained in the tunnel is very much greater than anything that could be achieved in a rotating machine.

A great deal can be learnt by the correlation of the performance of the row of blades in the wind tunnel with the performance under two-dimensional conditions with potential flow. The calculation of the potential flow past a row of blades used to be done by the method of conformal transformation. This process, which is a very tedious one, has now been replaced by the use of the electric tank.

Complicating Effects

The next step in the process is to measure the performance of similar blading in a compressor or turbine in which three-dimensional and centrifugal effects are present. It is difficult to get accurate results from a single-stage machine, since the changes in temperature are small and the entry and exit conditions exert an unduly large masking effect. On the other hand, if too many stages are used other difficulties will be introduced by effects of mismatching between the different blade rows. One, therefore, has to compromise and select the most appropriate machine for each experiment.

Having established the performance of blading in single stages and correlated this with the results of wind-tunnel tests, we have to take the final step of measuring what happens when a number of stages are added together to give a complete multi-stage compressor or turbine. The chief problem here is the effect of one stage on another and the objective is to so match the stages together that they give a good performance, not only under the design conditions of operation, but also over the whole running range and particularly at starting. It is probably true to say that at the moment the most serious problem in the high-pressure, axial compressor is that of obtaining sufficiently flexible operation over the whole working range.

Most of the low-speed wind-tunnel work and the tests on low-speed compressors and turbines can be done fairly cheaply without the expenditure of a great deal of power. But directly high Mach Numbers are approached and the testing of compressors and turbines of high pressure-ratio becomes necessary, one has to provide elaborate, expensive plant.

In the combustion chamber the research techniques used are rather different. The basic difficulty in all applied research on combustion is that the fundamental processes involved are not fully understood, so that most of the work is of a semi-empirical nature. In an effort to obtain a clearer insight into the nature of the combustion process work is being done on the burning in an air stream of single drops of fuel. Efforts are also being made to correlate the results of this work with the behaviour of clouds of burning drops, such as one obtains from the fuel injector in a combustion chamber.

A great deal of work is being done in making clearer the actual mechanics of the combustion process as it takes place in the confined space of the gas-turbine combustion chamber. There are, of course, limiting mixture-strengths, both on the rich and weak sides, beyond which burning cannot be maintained. These limits have to be determined for the various geometrical layouts in which we are interested, and the effects on these limits of the characteristics of the fuel and the inlet conditions of temperature and pressure have to be measured. For aircraft gas turbines the usual fuels are petrol and kerosene. For low-power marine and land plants, diesel oil and gas oil are satisfactory fuels, but the difficulties resulting from burning them under the special conditions obtaining in the gas turbine have not yet been fully mastered.

Although vibration is not present in the gas turbine to the same extent as it is in the piston engine, there is one part of the turbine engine, namely, the blades, in which severe vibration can occur. Each blade is subjected to fluctuating aerodynamic forces, due to its passage past the wakes of the preceding blades and to the presence in the airflow of bodies causing aperiodic disturbance in the flow. The resulting forced vibrations in the blades are usually not serious. Unfortunately, however, a blade has many possible modes of vibration, some flexural, some torsional and some a combination of the two; it therefore has a considerable number of frequencies at which it can resonate. The fundamental and several of the overtone modes of vibration may be sufficiently serious to cause failure if they are excited for long. It is therefore necessary to predict the various modes of vibration and arrange that those likely to be serious should not occur near the full speed of the machine. The magnitude of the forcing impulses may be greatly increased when a blade row stalls, and under such conditions there is a much greater chance of blade failure. Blade stalling usually occurs in the low-pressure blades of a compressor at low speeds. There are thus potentially dangerous conditions at both ends of the speed range. A great deal of work is being done on blade vibration in rigs, compressors, turbines and complete engines to obtain a clearer idea of the processes taking place.

A special problem on which considerable effort is being expended is that of cooling the vital parts of the turbine. Most present-day turbines are virtually uncooled, although aircraft units usually have a limited amount of cooling on the face of the turbine discs. The efficiency and power output

GAS-TURBINE RESEARCH . . .

of a turbine engine can be greatly increased by a moderate increase in the maximum gas temperature. But with present-day materials any further increase in metal temperature would have to be paid for by a reduction in life.

The answer is to cool the surfaces scrubbed by the hot gases. We already know, from wind-tunnel tests on cooled blades and surfaces, how much heat we have to abstract from the blades, rotor and casing of the turbine. The main problem still remaining is a practicable process for the fabrication of the blades and other members with integral cooling passages. This is a good deal more difficult than appears at first sight. However, a number of cooled turbines have already been run and satisfactory progress is being made.

In order to obtain more knowledge of what is going on inside the machine, many old techniques have been adopted and new ones invented. The temperatures of blades and other rotating parts can be measured by temperature-sensitive points, by the use of pellets whose melting point or whose hardness gives a measure of the temperature to which they have been subjected, by thermocouples connected through silver or mercury slip rings and by the use of radiation pyrometers.

Very accurate gravimetric methods of measuring the minute quantities of unburnt fuel in the engines exhaust, in order to determine the combustion efficiency, have been developed.

The measurement of the performance of blading has been cheapened and made more rapid by making tests in a compressor pumping water instead of air, using blades of type-metal, which can be easily melted down and used again.

Transition on the blading of compressors and turbines has been successfully indicated by the use of china clay, oil films, sublimation and soot.

Shock waves and other compressibility effects have been studied in both compressor and turbine blading by the use of Schlieren and interferometer techniques.

It is now possible to measure, while a machine is running, the temperature, pressure, velocity and direction of the working fluid; the temperature and stress in any part of the machine, rotating or stationary; the relative movement of and clearance between one part and another and, moreover, the variation of all these values with time. When these methods have been fully applied, the determination of an engine's capacity by trial-and-error testing to destruction should be a thing of the past.

SOMETHING NEW FOR THE NAVY—DE HAVILLAND SEA VENOM

Sea Venom N.F.20 is the official designation conferred upon this Ghost-powered all-weather day-and-night fighter, developed by de Havilland and ordered in quantity for Naval Aviation. Revealed in this unusually fine study is the arrester hook tucked away in the nacelle tail-fairing.

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VARIETY at DERBY

The Harben Trophy Race and Derby Club's "At Home"

AS we briefly recorded last week, the Harben Memorial Trophy Race, flown during the Derby Aero Club's "At Home" on May 19th, was won by F/L. J. Findlay. He is chief instructor of No. 16 R.F.S., Derby. This annual contest, for a trophy presented by the family of the late W/C. N. R. Harben, D.F.C., is flown between pilots employed by Air Schools, Ltd., and their associated companies, and Findlay was opposed by F/L. S. Robinson (C.F.I., Wolverhampton), F/O. E. Church (staff instructor, 16 R.F.S.) and F/L. N. W. Fagg (staff instructor, 25 R.F.S., Wolverhampton); all the competitors flew Magisters, handicapped on known performance. At the end of the four laps of a five-mile circuit, on which the aircraft were within view of the spectators throughout, the winner was as mentioned above, with Church second and Robinson third.

The air display was on more spectacular lines than the modest title of "At Home" suggests. A brilliant demonstration of the Nene-Canberra was given by S/L. J. Heyworth, who made his turns within the airfield perimeter and also executed a slow-speed fly-past within 20ft or so of the ground; and the Patrouille d'Etampes, led by Capt. Izaac, repeated the unique formation aerobatics which they had performed at Shoreham and Hucknall the previous week-end. Another formation-aerobatic item, equally distinguished in its own way, was contributed by four Seafires (leader, Lt. Cdr. R. F. Hallam) of No. 1833 (City of Birmingham Squadron), R.N.V.R. Two Meteor flights from No. 504 (County of Nottingham) Squadron, commanded and led by S/L. G. J. Beardsall, gave an excellent demonstration of air drill, ending with a beat-up in line astern followed by an upward roll.

Mrs. Harben presents the Harben Trophy to the winner, F/L. J. Finlay.

Of the individual aerobatic turns, mention must be made of the high-speed demonstration by F/L. J. G. Beckett (Meteor 7), adjutant of No. 7 Squadron, and, in contrasting style, of the Chipmunk display by F/L. J. Johnson of Home Command Instrument-training Unit, Honiley. Glider aerobatics were contributed by Mr. G. Smith, C.I. of the Derbyshire and Lancashire Gliding Club.

There was a good leavening of events of a less conventional nature, such as the "veteran pilot trying his hand" (S/L. Smith of No. 16 R.F.S. crazy-flying a Tiger Moth); a one-engined-feathered landing in an Anson by F/L. Findlay of No. 16 R.F.S.; and "air transport *à la mode* (S/L. Ranald Porteous, mounted on a motor cycle, disembarking from an Aerovan and riding across to the "castering" Auster, on which he then proceeded to give his well-known demonstration. No display is complete without a parachute jump, and the performer on this occasion was Major Willans.

The event, which was watched by some 12,000 people, went well to schedule, with no waits between items; and a special word of praise must go to the compilers of the printed programme, which (unlike many we have seen) was unusually comprehensive and accurate in its details.

In the evening the club entertained the pilots of No. 504 Squadron and the Patrouille d'Etampes.

Low-down business: S/L. J. Heyworth provides the Derby spectators with a close-up of the Nene-Canberra.

WOOLSINGTON under the WEATHER

WHAT was to have been a large-scale air display staged at Woolsington, last Saturday, by the Newcastle-upon-Tyne Corporation, was reduced to the status of a small-scale "at home" by the weather—local "sea-fret," which involved a 300-ft cloud-base, 1,000-yd visibility, 5-10 kt. N.E. wind and occasional drizzle. Anything in the nature of large-scale aerobatics would have been out of the question, so promised Service and Industry support, though willing enough to attempt to get through, was dissuaded by telephone.

Nevertheless, as some thousands of blue-nosed but hopeful burghers were lining the ropes by 2 p.m., it was decided to go ahead with an impromptu flying programme by mainly local talent, plus motoring and other ground events already scheduled.

We say "local talent" in no derogatory sense, for at Newcastle it happens to be of an unusually high order. P. W. E. Heppell instructured-and-pupilled in a Tiger Moth; Capt. T. J. Thomason of Oldstead Aircraft meted out some startlingly unconventional treatment to the company's willing Rapide; Heppell and K. C. Millican, the latter in a Magister, pursued toy balloons down-wind and (occasionally) burst them; and F/L. King, standing in the passenger seat of the Millican Magister, aimed a .303 rifle at bottles perched upon a mysterious erection on the ground, the bottles thereupon disintegrating with the unfailing regularity associated with this time-honoured illusion.

The sole Service visitor, a Naval Aviation Beechcraft Expediter, all the way from Lee-on-Solent—where it does duty as admiral's barge for Flag Officer Air (Home)—was prettily demonstrated by Lt. Gordon Davidson, a local enthusiast who has lately found himself recalled for 18 months' R.N.V.R. training. Each zoom took him into the ceiling.

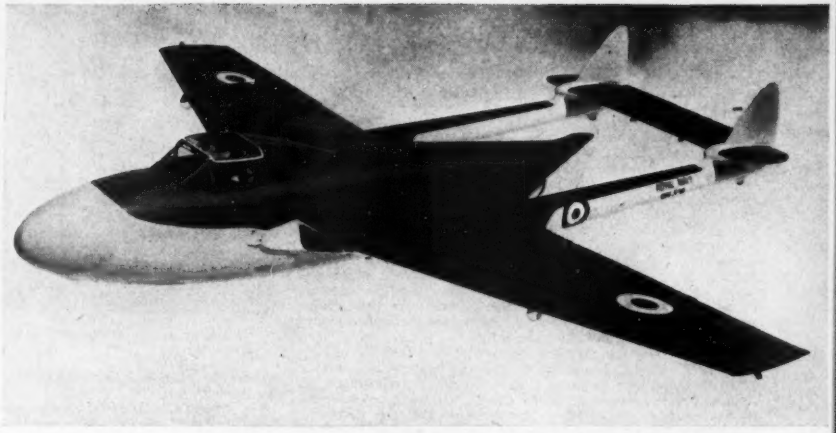
Finally, a free-for-all handicap race was magically organized almost in a matter of minutes. It called forth a Tipsy, a Tiger, a Cygnet (of rarity value as one of the few remaining examples of the tricycle two-seater pioneered by General Aircraft *circa* 1937) an Auster, a Magister, the Rapide and the Expediter. The five-lap course was almost entirely within the airfield perimeter, and the excitement was terrific. One felt that if air racing always looked like this, it would be far more popular as a public spectacle. The Auster (Heppell up) won, with the Cygnet (Costella) a hot second and the Rapide (Thomason) third.

During the afternoon, Woolsington's lately extended runways (E.W. 4,000ft, N.S. 3,200ft) were officially inaugurated by the Lord Mayor of Newcastle.

SIDDELEY TROPHY RACE ENTRIES

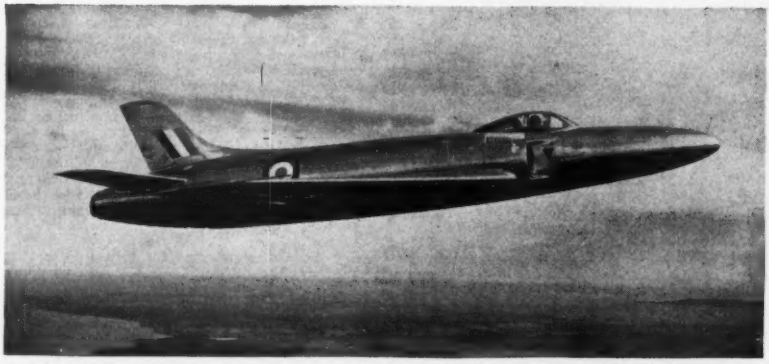
ON May 18th, in publishing entries for the Festival of Britain 1951 National Air Races, we stated that entries for the club contest, the Siddeley Challenge Trophy Race, would be announced later. These details have since been received, and are as follow (clubs, pilots and aircraft):—

Darlington and District Aero Club, T. W. Hayhow (Aiglet); Herts and Essex Aero Club, W. T. Franklin (Gemini 1a); Lancashire Aeroplane Club, F. Dunkerley (Gemini 1a); Leicestershire Aero Club, A. E. Coltman (Hawk Major); London Aeroplane Club, W. P. Bowles (Messenger II), J. Cooper (Moth Minor), T. R. Hilton (Chipmunk), Martin Sharp (Chipmunk); Newcastle Aero Club, K. C. Millican (Proctor III); Redhill Flying Club, E. Westbrook (Messenger IVa), K. M. Freeman (Hawk Trainer III); Rochester Flying Club, E. Day (Hawk Trainer III); Southend Municipal Flying School, Dr. W. L. James (Chilton); Wiltshire Flying Club, P. Q. Reiss (Hornet Moth), Geoffrey Marler (Falcon Six); Wolverhampton Aero Club, D. C. Jemmett (Hawk Trainer), J. H. Ashton (Hawk Trainer), R. R. Paine (Hawk Speed Six).



Successor to the de Havilland Sea Hornet N.F.21 is the Sea Venom N.F.20, radar-equipped, and having side-by-side seats for pilot and navigator-radar operator. Provision is made for tip-tanks which need not be jettisoned for combat. The turbojet is a D.H. Ghost of at least 5,000 lb. thrust.

PUGNACIOUS AND PACIFIC

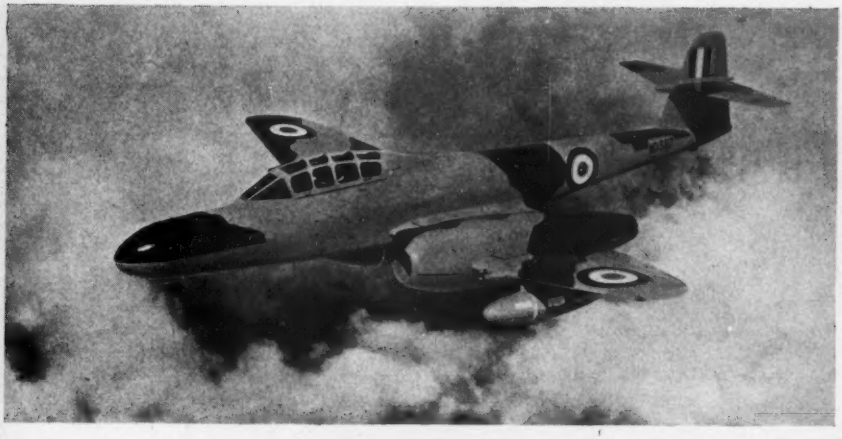


This latest development of the Vickers-Supermarine 535 fighter (Rolls-Royce Nene) is characterised by a shapely dorsal fin, as shown in this recently-secured study, with the Isle of Wight beyond.

"Flight" photograph

Another appealing view of the modified Vickers-Supermarine 535, forerunner of the Swift, as ordered in quantity for the R.A.F. with a Rolls-Royce turbojet unit of unspecified type.

"Flight" photograph



Seen carrying its belly tank and under-wing tanks for maximum endurance is the Armstrong Whitworth (Gloster) Meteor N.F.11 night fighter for the R.A.F. The tail is that of the Mk.8; the enclosure follows Mk.7 practice, and the long-span wings are similar to those of the original Mk.4.

Passenger comfort of an altogether exceptional order has been achieved in the Vickers-Armstrong Viscount 700 by the adoption of Rolls-Royce Dart turboprops and by the utmost care in planning seating arrangements.

"Flight" photograph

This second new air-to-air impression of the Viscount 700 displays the large, oval cabin windows, each of which is an emergency exit. Viscounts are on order for B.E.A., Air France and Aer Lingus.

"Flight" photograph

CIVIL AVIATION

HELICOPTER SCHEDULE: Today, June 1st, British European Airways will inaugurate a new scheduled helicopter passenger service between London, Northolt and Birmingham airports. Sikorsky S-51s, one of which is seen here at Northolt, will make three return flights over the route each week-day.

VISUAL-RANGE MEASUREMENT

THE M.C.A. is to introduce a system of measuring runway visual range at airfields when visibility falls below 1,200 yards. When sunlight is combined with haze or smoke fog, lights sometimes cannot be seen as far as can runway markers. It is therefore proposed to add, at M.C.A. airfields, an additional row of runway markers which will extend along both sides of the instrument runway at intervals of approximately 100 yards. The markers will be 6ft long, triangular in section, stand 3ft 3in high from the ground, and will be placed four yards from the runway edge. Runway light range will be measured from the control caravan or an equivalent position, and will consist in counting the number of lights (or gooseneck flares) which are visible. This figure will then be converted to the distance in yards at which a pilot would be able to see the runway lights if his aircraft were stationary on the ground at the downwind end of the runway. The same system will be used for measuring runway marker range.

PRINCES SELLING WELL

SUBSTANTIAL orders have been reported during recent weeks for the Percival Prince, which received its full C. of A. in December, 1949. Two Survey Princes will go to the Government of Tanganyika, and further aircraft of this type have also been ordered by Thailand and Switzerland.

The Ministry of Supply has also ordered a number of Princes on behalf of the Long Range Weapons Organization in Australia, for whom an initial batch has been earmarked for communications and freight duties. Several more will become the property of the M.C.A., who will use them to fulfil the varied duties which the Ministry's telecommunications branch is called upon to perform. They will be used, particularly, in connection with the testing of co-ordination of airfield control systems and to check the functioning of radar, radio and navigational aids throughout the British Isles.

Further Princes are being delivered to the Brazilian feeder-line, Aeronorte; they will be equipped to carry 12 passengers. In addition a number of 8-10 passenger versions, to be used to convey personnel, freight and equipment, have been ordered by the Shell Petroleum Co., for use in the oilfields of Venezuela and Borneo.

COMET TO CAIRO

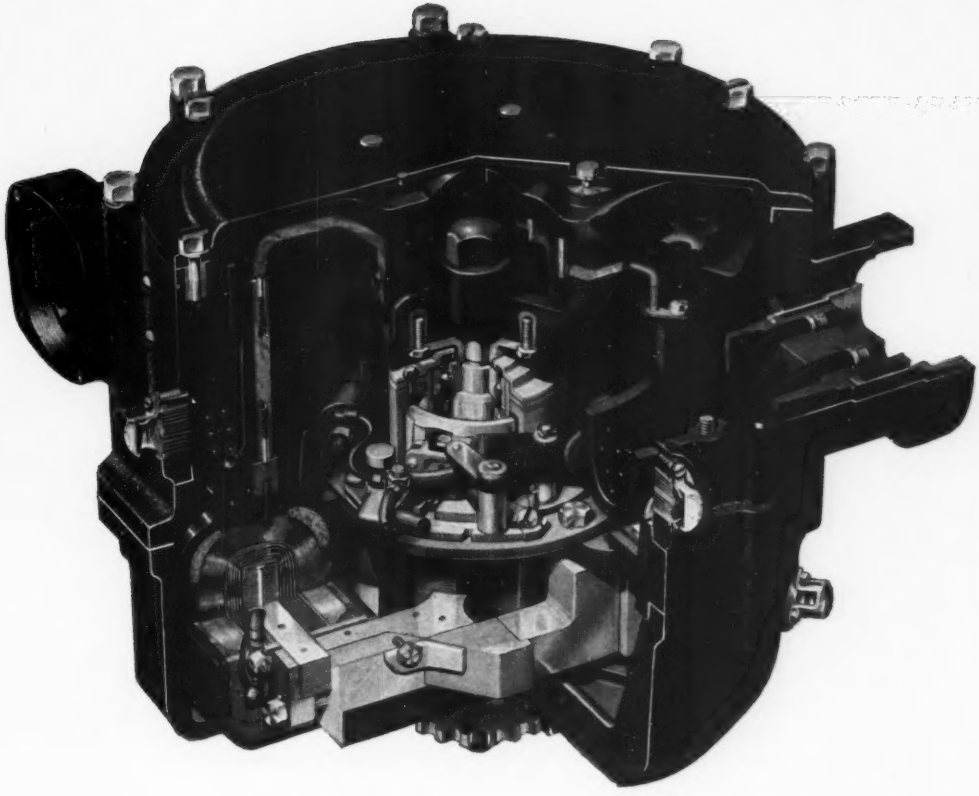
ON its first official overseas development flight, the Comet on loan to B.O.A.C. left London Airport on May 24th for Rome, 908 miles away, where it arrived exactly 2 hr 13 min later. This is approximately half the time taken by airliners now in service. The aircraft, which was piloted by Capt. E. E. Rodley, then took off for Cairo, where it landed in 5 hr 22 min flying time ex-London. There were 23 passengers on board, among them Capt. M. J. R. Alderson, manager of B.O.A.C's Comet flight. Average speed throughout the trip was 450 m.p.h., and at Farouk Airport, where the Comet landed with ice still visible on its wings, it was one hour ahead of schedule. It has since flown to Nicosia, Cyprus, and was then due to visit Beirut (both of these airports may have to be used as alternatives when Comets are operating on B.O.A.C.'s scheduled services to the Middle East). The Comet was due to leave Cairo on Monday for London Airport from Rome.

This development flight forms part of an extensive programme which is being carried out to test traffic-control and operating techniques, route weather-conditions and the performance and suitability of communications and navigational aids along the routes to be flown. The aircraft used on the Cairo flight was actually the second prototype, which is not fully furnished.

While route trials are in progress, the Comet production line at Hatfield is reaching an advanced stage. B.O.A.C.'s order for nine aircraft is being followed by three more for C.P.A. and two for the French company, Chargeurs Réunis S.A. of Paris. Following these deliveries the long-range Series II Comets, powered by Avons, will be built for B.O.A.C. and Panair do Brazil, and more orders are also expected.

Recently Sir Frank Whittle, who is a technical adviser to B.O.A.C., is reported to have discussed in South Africa the

APPROVED: Sir Miles Thomas, B.O.A.C.'s chairman, with Col. W. C. Devereux, managing director of Almin, Ltd., at last week's "christening" of the new three-bay hangar at London Airport. Believed to be the first all-light-alloy hangar in the world, the structure was built by S. M. D., Ltd., a subsidiary of Almin, Ltd. *(Further information under "Brevities", page 655)*



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CIVIL AVIATION . . .

ONE-FAN WONDER: As reported on this page, a new American twin-engined executive aircraft, the Aero Commander, recently made a remarkable flight from Oklahoma to Washington, a distance of 1,160 miles, on one engine only.

proposed change-over to jet-powered airliners on the U.K.-South African services. The problems involved are those concerning the replacement of Hermes by Comets without disrupting the interlocking timetables. The Comet would fly the Springbok service in 14 hr, as compared with the 27 hr now taken by South African Constellations. S.A.A. will probably retain their Constellations for the time being which would mean, of course, that alternate services would be relatively slow. A South African report states, however, that S.A.A.'s Constellations will eventually be replaced by jet-powered aircraft; when this happens, services will again become uniform.

YORKS FOR L.A.C.?

NEGOTIATIONS are known to be well advanced between the Lancashire Aircraft Corporation and B.O.A.C. for the purchase of 23 fifty-seater Yorks which B.O.A.C. withdrew from service last year. Although the aircraft cost between £75,000 and £100,000 when new, a disposal price of £5,000 each has been mentioned; they are said to be in good order and are entirely suitable for charter work.

With them Lancashire would undoubtedly be able to carry out their plan to form an Auxiliary transport squadron similar to that already operated by Airwork, Ltd.

TWIN ON ONE

WHETHER or not such demonstrations are in the best interests of aviation as a whole, a flight made on May 9th by the new Aero Commander, a twin-engined executive machine, certainly attracted attention; the aircraft was flown from Oklahoma City to Washington, a distance of 1,160 miles, on one engine from standstill to standstill. In order to guarantee that no extra power would be available during take-off or landing (and, of course, no drag from the airscrew blades), the port airscrew was removed. At a gross weight of 4,800 lb, the Commander was able to taxi to take-off position after a 2,700-ft run, and to attain adequate cruising height, on the power of its remaining 260 h.p. Lycoming engine. The pilot was the makers' flight operations manager, Mr. Bert Bantle, who had with him a former airline pilot as observer.

On one engine, it is claimed, the Commander cruises at a true air-speed of 132 m.p.h. on 70 per cent of normal cruising power, while fuel consumption at this setting is less than 14 gal/hr.

With both engines in use the "take-off to 50 ft" distance is 950 ft. The aircraft is a six-seater which normally cruises at 197 m.p.h.; it has a rate of climb exceeding 2,000ft a minute and a service ceiling of 24,000ft. In spite of this relatively high performance, landing speed is said to be as low as 57 m.p.h. under maximum-load conditions.

The Aero Design and Engine Co., Tulakes Airport, Oklahoma City, are the constructors, and Mr. T. R. Smith, who was formerly with Douglas, is largely responsible for the design. His aim was to produce a businessman's aircraft which would provide twin-engined safety, exceptional comfort for five to seven passengers and a high cruising speed, allied with a simplicity of design which would permit manufacture at relatively low cost. The first production model is due off the line this month.

DECCA AT I.C.A.O.

ON May 8th, the United Kingdom delegation to the fourth session of the International Civil Aviation Organization in Montreal presented to the Communications Division a working paper describing the Decca Navigator system and its recent developments. It was the officially expressed view of the United Kingdom authorities that the Decca system with its new air presentation (the Flight Log), and freedom from ambiguity (Lane Identification), has now been developed to a point at which the I.C.A.O. will wish to give it careful study.

On the following day a working paper on the Decca Navigator was presented by the French delegation. The paper stated that (i) following flight tests carried out in France using the emissions of the U.K. southern chain of stations, the French government has decided to establish a Decca chain—it will consist of four stations, and will be of the high-power type with radiating masts 100 metres (329ft) high; (ii) the chain will be located in the central region of France, thus providing coverage for metropolitan France as well as suitable overlap with the neighbouring chain(s) already established (south of England) or being installed (south-west of England and western Germany); (iii) the bases have been selected in such a manner that the system of hyperbolae will meet air navigation requirements; (iv) the chain is scheduled to start operating by the end of next year.

BREVITIES

ON May 19th, Cambridge County Council employed a Hiller 360 helicopter of Pest Control, Ltd., to take pictures, at 15 sec intervals, of traffic movements in Cambridge streets. The pilot was Mr. J. E. Harper, aviation manager of Pest Control, Ltd.

* * *

A new American record for light aircraft was established recently when Mr. Max Conrad flew non-stop across the United States from coast to coast in a Piper Pacer in 23 hr 4½ min. He beat the previous record by 7 hr 43 min.

* * *

In five years of transatlantic operation, K.L.M. have completed 5,320 flights between Europe and America, on which 170,000 passengers, 4,500 tons of freight and 760 tons of mail were carried. The nine Super Constellations on order for K.L.M. will be used on North Atlantic services in 1953.

* * *

A party of 13 Australian airline representatives and R.A.A.F. officers recently left Sydney to carry out a survey of landing facilities on the Cocos Islands in the Indian Ocean. The survey is being made in connection with the proposal for an air link between Australia and South Africa.

* * *

The Irish Airline Pilots' Association, which has been negotiating salaries and conditions of service with Aer Lingus, has announced its decision to affiliate with the Workers' Union of Ireland.

Category "C" Customs facilities have now been made available at Luton airport. Pilots wishing to make use of these arrangements should contact Flying Control at the airport, telephone No. Luton 939.

* * *

Australian National Airways have completed their first cargo charter between Australia and New Zealand. On the 6,350 mile return trip a DC-4 carried seven tons of wool-tops to the Auckland mills to relieve a shortage caused by a shipping strike. The return flight was made with seven tons of clover seed.

* * *

The new aluminium hangar at London Airport, illustrated on page 654, has three 100ft-long bays with clear spans of 125ft and 30ft door-height, and is an example of a new quick-erection design by S.M.D., Ltd. Extrusions and castings were supplied by associated companies of Almin, Ltd., plate and sheet by the British Aluminium Co. and T. I. Aluminium, Ltd., respectively, and asbestos by the Cape Asbestos Co., Ltd.; Esavian doors are employed.

* * *

Representatives of leading British aircraft manufacturers are in Australia to discuss with Qantas, B.C.P.A. and T.E.A. the re-equipment of their fleets. As Qantas operates a parallel service with B.O.A.C., it is not unlikely that the discussions may result in Q.E.A. enquiries for Comets. T.E.A., incidentally, have just order another of the Solents, which were formerly operated

CIVIL AVIATION . . .

by B.O.A.C. This addition to the fleet is to be the *City of Belfast*, which was christened by the Lord Mayor of that city at Queen's Island in July, 1949. It is also announced that the M.C.A. has been able to release a second Solent, *Salcombe*, for service with T.E.A., who are already using one Solent and several Hythes on flights between Sydney and Fiji, and between New Guinea and Sydney/Hobart.

* * *

Press officer for Qantas Empire Airways in Sydney, Miss Marjorie McGrath has been visiting this country to set up a new publicity organization in London under Mr. John Keegan. She flew home last week-end, having found, she told us, all too little time to see and do all the things she had planned.

* * *

Air Beef, Ltd., began operations in the Kimberley region of North West Australia in May and expect to handle about 5,000 head of cattle this year, as compared with 3,760 last year. Air Beef is seeking a subsidy of £17,000 (based on this year's production), so that the scheme can be extended to serve the whole of the North West cattle areas of Australia.

* * *

On June 28th, Tasman Empire Airways will begin the operation of a service between Melbourne and Christchurch. The aircraft to be used, a DC-4 on charter from Q.E.A., will fly once weekly in each direction. Further news from Australia indicates that plans are going ahead to install I.L.S. at 13 of the main airports in the country. Sites for the systems are now being selected and the first equipment is expected to be delivered early next year. At a cost of £820,000, also, the number of radio ranges along Australian routes is to be doubled.

EARLY BIRDS: As mentioned on this page, at least 84 members of the private flying fraternity left their beds at an uncomfortably early hour on May 20th to battle their way through the Rochester "defences" in search of a free breakfast. This neatly parked array of visiting aircraft suggests that they were well awake on arrival.

FROM THE CLUBS

A TOTAL of 167 hr was logged by aircraft of the Strathtay Aero Club in April, when only 20 of the 30 days were available for instructional flying. A considerable number of keen new pilot members have enrolled and hope to qualify for their licences shortly. One young pilot put up an unusually good performance recently when he went solo after only 3 hr dual on a Tiger Moth.

S.A.C. is particularly proud of the fact that one of its A.T.C. pupils, F/Sgt. S. I. Turner, has been selected by Home Command and the Royal Aero Club as the most efficient cadet to undergo training since the inception of the scholarship scheme in July, 1950. This distinction carries the prize, awarded by the Royal Aero Club, of 6 hr extra flying, which covers the requirements for a renewal of F/Sgt. Turners' Private Pilots' Licence.

The Strathtay Aero Club operates from Perth Airfield. Intending members should contact the secretary at 1, Charlotte Street, Perth.

COMMONWEALTH CONTENDER: Geoffrey C. Marler, seen here with the Miles Falcon Six which he will fly in the King's Cup and Norton Griffiths Trophy contests, is the only Commonwealth entrant in the forthcoming Festival of Britain National Air Races. A New Zealander, and international sales director of a group of shoe companies, he uses personal aircraft extensively for business journeys.

THE social committee of the Rochester Flying Club ran a highly successful breakfast patrol on May 20th. In spite of the forbidding weather 84 visitors arrived in 30 aircraft; eight of the aircraft successfully penetrated the defences and their crews therefore enjoyed the extra flavour imparted to the traditional eggs and bacon by the knowledge that they were being supplied free of charge. In all over 100 people sat down to breakfast in a marquee erected for the occasion. Mr. "Tich" Freeman, of Redhill, was awarded the "time-of-arrival" prize and Mr. Cooper, of White Waltham, gained the award for having made the longest flight to the event.

As a "Festival" contribution, Cowes Aero Club is actually *paying* visitors to land at its airfield this summer; arrival there any time after 11 a.m. next Sunday, June 3rd, will entitle a pilot to a shilling voucher to spend in the club-house.

FORMER members of the South Coast Flying Club will be glad to hear that flying and social activities are still available at Shoreham. The new club, known as the Southern Aero Club, is under the management of Mr. F. G. Miles, who, with Capt. Cecil Pashley, founded the original club in 1925. Flying is available on Magisters and Austers; normal rates are £3 5s. per hour dual and £3 per hour solo. Aircraft servicing is carried out by F. G. Miles, Ltd.

THE Fair Oaks Aero Club, located at Chobham, Surrey, recorded a total of 188 hr in April. Notable events during the month included the award of two Private Pilots' Licences to A.T.C. personnel, and the achievement of the C.F.I., W/C. Arthur, who recently completed the equivalent of year in the air (8,760 hr).

As mentioned elsewhere, tomorrow, June 2nd, the club will be "At Home" from 6 p.m. to visitors from other clubs, and a flying display will take place, followed by a flannel dance (tickets, 4s. 6d.) from 9 p.m. until 1 a.m.

THE Australian Minister for Air, the Hon. T. W. White, D.F.C. (who is shortly coming to Britain as High Commissioner) has announced that the subsidy for pilot training which, until recently, was restricted to Australia's major clubs in capital cities, has now been extended to all non-profit flying clubs, provided they meet with the Department's standards of training.

To assist private owners, also, many regulations now in force have been amended with the object of reducing form-filling. Licences for both student and private pilots have been extended from 12 to 24 months. In addition, private pilots have been granted free use of priority telephone and telegraphic services for obtaining information and for notification of movements.

THE KING'S COLOUR PRESENTED

Impressive Hyde Park Ceremony in the Rain

HOW well the Royal Air Force does everything! On Saturday last, in Hyde Park, with the elements conspiring together to ruin the occasion, a magnificent parade and fly past was completed in every detail to celebrate the presentation of the King's Colour to the Royal Air Force in the United Kingdom.

It had been His Majesty's intention to make the presentation himself but, unfortunately, he was suffering from a mild attack of influenza. His place was taken by Princess Elizabeth.

Watching the representatives of the combatant commands march on to the parade ground in Hyde Park, one could easily imagine that drill was their only occupation instead of being but a secondary side of the Service's activities. It was a little ungallant, perhaps that the W.R.A.F. should have been the last contingent to march on, but their bearing was well up to the general standard. They were wearing, for the first time, the new-style felt hats.

As soon as the twelve representative squadrons and the massed bands were in position the cased Colour was brought on by an escort squadron of 180 officers and men drawn from all the R.A.F. commands in the United Kingdom and from No. 90 Group. The Colour party (F/O. D. Mullarkey, F/Sgt. S. C. Orrell and F/Sgt. J. E. W. Tonks) laid the Colour on the piled drums.

Princess Elizabeth and other members of the Royal Family then arrived and, immediately after the royal salute and national anthem, the Vampires and Meteors of Fighter Command tore across the sky just below the ragged rain-clouds, which by now were building up fast. To join up a number of formations and fly over a saluting-point at an exact time is difficult even with slow aircraft in perfect weather. To have done so well with jet fighters in Saturday's weather conditions was little short of miraculous.

Representing His Majesty the King, Princess Elizabeth, steps out from beneath the umbrella and hands the Colour to F/O. D. Mullarkey, the bearer.

For the inspection the Princess mounted an open utility vehicle, accompanied by Air Chief Marshal Sir Ralph A. Cochrane, A. Cdre. R. N. Waite and G/C. P. W. Townsend. Clasping a cross-bar she stood while she inspected the whole of the parade. Although there were no slow-marching orderlies as are customary in R.A.F. inspection parades, the two traditional slow marches *Greensleeves* and *Skye Boat Song* were played by the massed bands.

Her Royal Highness inspecting one of the twelve representative squadrons. Fortunately the rain held off until after the inspection was completed.

The inspection completed, Her Royal Highness returned to the dais, and the escort squadron having formed hollow square, the Colour was consecrated by the Rev. Canon L. Wright, K.H.C., chaplain-in-Chief of the R.A.F. This service was most impressive, especially in its opening, when the parade commander, A. Cdre. R. N. Waite, asked "Reverend sir, on behalf of the Royal Air Force, we ask you to bid God's blessing on this Colour." To this Canon Wright replied, "We are ready so to do. We are gathered together here to consecrate this Colour, the solemn symbol of our loyalty, and with it ourselves, our service and our life. May this Colour never be unfurled save in the cause of justice, righteousness and truth." Then, after the responses and the escort squadron having been called to attention, the Chaplain-in-Chief, laying his hand on the Colour, said "To the glory of God and as a symbol of our fellowship with him and with each other, we consecrate this Colour . . . ." At the conclusion of the service the bearer advanced to the piled drums and received the Colour from Princess Elizabeth.

By this time the weather had broken completely; the rain teemed down. An umbrella was held over the Princess, who then read the address which the King would have given had he been able to attend. In this he said, "I am very glad to present my Colour to the Royal

SERVICE AVIATION . . .

Air Force in the United Kingdom.

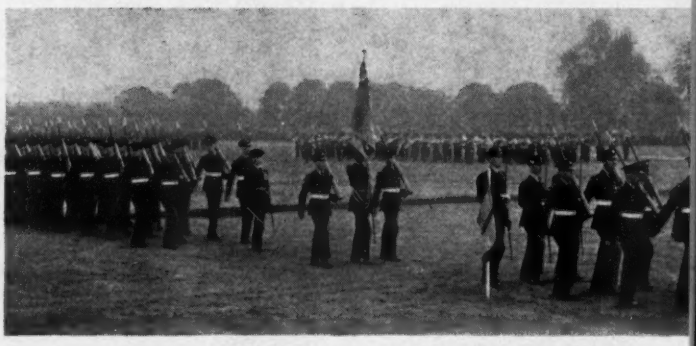
"Your Service was formed during the reign of my father, King George V, and I myself have had the closest ties with the Royal Air Force since its formation in 1918. I have watched with the keenest admiration how it has grown up from those early days to prove in every way worthy of its place alongside the older Services. During the dark days of 1940, when my people stood alone to defend the cause of freedom, the Royal Air Force played the foremost part in turning the tide which led to ultimate victory.

"The courage and determination which have marked your achievements in war have been matched in their quiet heroism by many feats of daring and enterprise that your service has been called upon to perform in times of peace.

"The great traditions of the Royal Air Force have been established through unflinching devotion to duty, and I am deeply conscious of the many gallant young lives which have been laid down not only in conflict with the enemy, but in facing the many hazards which are in the very nature of your ordinary duties.

"I now hand over this King's Colour, confident that you will honour it as the emblem of your achievements and the shrine of your Service traditions. Let it be a reminder to you of the devotion and sacrifices of your predecessors and a symbol of the trust which I repose in the Royal Air Force."

In reply to the King's message the parade commander said:



The escort squadron marches-off the Colour as the massed bands play the Royal Air Force March.

"Your Royal Highness: Be assured that the R.A.F. will respect the high honour which you have so graciously bestowed upon us today on behalf of His Majesty The King and in the presence of Her Majesty the Queen, Queen Mary, and other members of the Royal family.

"It is the common purpose of all ranks to uphold the standard of selfless devotion to duty set by our predecessors in the Service. This Colour will symbolise that purpose. It will be a memorial to the fallen and an inspiration to those who have yet to serve."

The presentation finished, the escort squadron reformed line and marched past in slow and quick time; it finally advanced in review order, giving the royal salute and three cheers for the King.

This is the second Colour to be presented. The first was to the R.A.F. College, Cranwell, in July, 1948. Another has been approved for No. 1 School of Technical Training, Halton, and a number of squadrons which have completed 25 years' service have also been awarded a King's Colour, though no actual presentations have as yet taken place.

The new Colour will be kept by the R.A.F. Regiment at their headquarters at Catterick, and will be paraded for the first time in the triple guard when the King opens the Royal Tournament on June 6th.

The New First Sea Lord

ADMIRAL SIR RHODERICK R. McGRIGOR, G.C.B., D.S.O., has been appointed First Sea Lord and Chief of Naval Staff in succession to Lord Frazer of North Cape. During the last war, while serving with the Home Fleet, he directed air operations against the *Tirpitz* and flew his flag in various carriers, including *Victorious*, *Formidable*, *Indefatigable*, *Campania* and *Searcher*.

Vice-Admiral M. J. Mansergh will succeed Sir Rhoderick as C-in-C. Plymouth.

Western Union Air Appointments

AFTER more than two years as chief of staff of Western Union Air Forces in Central Europe, A. V-M. W. A. Brook is returning to the R.A.F. He will be succeeded by Lt. Gen. P. Fay, vice-chief of the French air staff. The two deputies to serve under Gen. Fay will be A. V-M. T. Pike (Operations) and Brig. Gen. W. Thurman, U.S.A.F. (Admin.).

R.A.F. and R.C.A.F. Appointments

TO replace A. Cdre. W. Wynter-Morgan, who is retiring from the R.A.F., A. Cdre. C. L. Dann has joined the British Joint Service Mission in Washington, for technical duties. Since February, 1948, A. Cdre. Dann has been chief superintendent of the rocket propulsion department of the Ministry of Supply.

G/C. J. A. S. Outhwaite, O.B.E., has been appointed to Fighter Command and G/C. J. A. Hawkings to Transport Command as Senior Technical Staff Officers, each in the acting rank of air commodore.

At the end of June Air Marshal Sir Philip Clermont Livingston will retire from the post of Director-General of R.A.F. Medical Services and will be succeeded by A. V-M. J. MacConnell Kilpatrick.

A. Cdre. R. A. London, R.C.A.F., has retired from his position as Deputy Air Member for Technical Services at R.C.A.F. headquarters. His place will be taken by A. Cdre. V. S. J. Millard.

Carriers As Troopships

THE movement of the 16th Independent Parachute Brigade to the Middle East is considered to be so urgent that the carriers H.M.S. *Triumph* and *Warrior* have been taken out of service for use as troopships. The Air Ministry has announced the departure of Hastings aircraft to the brigade's destination.

Production Varsity Flies

IN the hands of George Lowdell, the first production Vickers Varsity aircrew trainer made its maiden flight on May 21st, when it flew from Brooklands to Wisley.

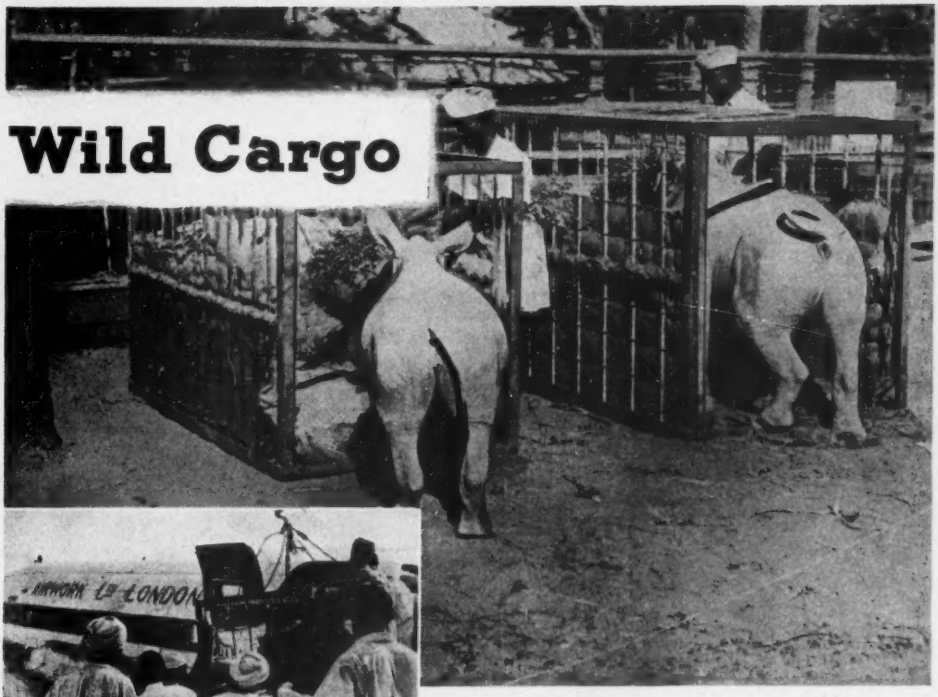
Courtesy Visits

WHEN the carrier H.M.S. *Indomitable* (Capt. M. L. Power, C.B.E., D.S.O., R.N.) leaves home waters on June 14 to pay a courtesy visit to Stockholm for six days, she will wear the flag of the C-in-C. Home Fleet, Admiral Sir Philip L. Vian, K.C.B., K.B.E., D.S.O., R.N.

The destroyer *Cadiz* will accompany her. On returning to England *Indomitable* will visit a number of home ports and resorts.

TAKING A BOWL TOGETHER AGAIN: Members of the Goldfish club (rubber-dinghy "rescuees") held their first reunion at the White House, London on Saturday. After dinner a dinghy was launched in the adjoining swimming pool; the crew included the only woman member, Mrs. M. Cornwall.

Wild Cargo



Inset on left shows two rare white rhinoceroses being loaded on an Airwork aircraft for Antwerp.

The above illustration shows the white rhinoceroses being enticed into cages at the Khartoum Game Reserve.

Many and varied are the tasks entrusted to the Air Transport Division of Airwork Ltd. The extent of the variety can, indeed, be glimpsed in these two pictures. The more usual tasks include the carrying of personnel, freight or mail between points not otherwise served.

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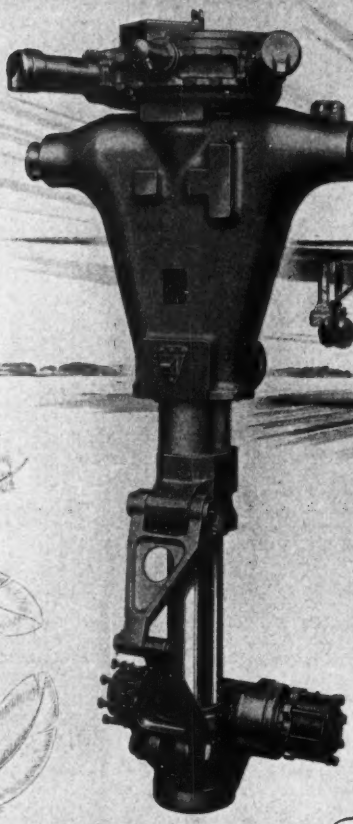

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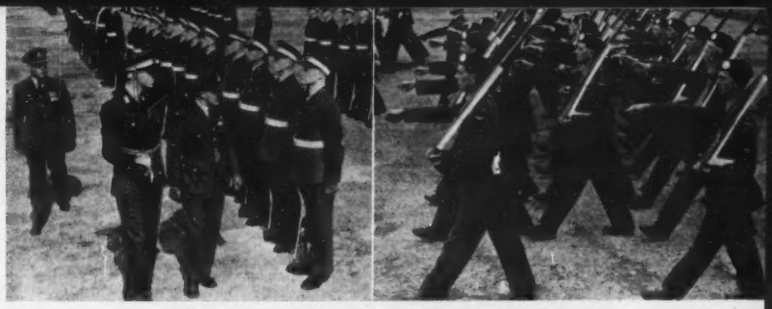
CANADIAN DAY AT DIGBY

Illustrated by "Flight" Photographs



(Left) S/L. R. T. P. Davidson, D.F.C., the C.O. of No. 421 Squadron, R.C.A.F., inspects the guard of honour. (Right) No. 2 Flight march past in the passing-out parade of No. 5 Entry, No. 2 I.T.S.

IT is doubtful whether R.A.F. Station Digby, since its construction by Irish labour and German prisoners in 1917, has had such a full and varied day as it did on Wednesday of last week when the morning brought a visit of No. 421 (Fighter) Squadron, R.C.A.F., to this, its old home, and the afternoon witnessed the passing-out parade of No. 5 Entry from No. 2 Initial Training School.

Digby, Lincs, was the birthplace of No. 421 and a number of other Canadian squadrons. From 1942 to 1945 it was under the command of G/C. McNab, and was known as R.C.A.F. Station Digby.

As No. 421 Squadron are now stationed once more in this country—at Odiham—it was appropriate that they should revisit their old base. The original intention had been to fly the squadron Vampires direct to Digby but, because of the absence of runways, and the small dimensions, it was decided that the landing should be made at Waddington, the crews then being flown on to Digby in a couple of Transport Command Valettas.

After No. 421's commanding officer, S/L. Davidson, had inspected the guard of honour mounted by D Squadron of the R.A.F. College (the Equipment and Secretarial Wing, which has been awarded the honour of being the King's Squadron) the air and ground crews proceeded to the nearby Scopwick churchyard, in which a number of Canadian airmen are buried and where a Cross of Sacrifice was unveiled in 1950.

At a brief but impressive service, wreaths were laid by G/C. M. D. Lister, S.A.S.O., R.C.A.F. (representing the High Commissioner), A.V-M. F. F. Inglis, who deputized for the A.O.C.-in-C. Flying Training Command, and G/C. D. Lumgair, Station Commander, Digby.

After lunch A.V-M. Inglis was the reviewing officer at the passing-out parade of No. 5 Entry, No. 2 I.T.S. These pupils are National Servicemen who have been selected for commissioned aircrew training. At Digby they go through a 12-week course which includes about 12 hours' flying in Tiger Moths. This flying is done at No. 2 Grading School, a civilian-manned unit run by Airwork, Ltd., at Digby. Its purpose is to decide suitability of pupils for pilot or navigator duties.

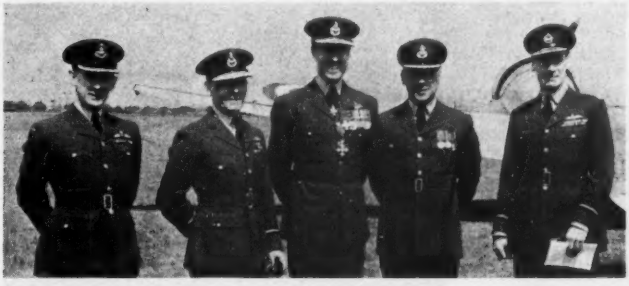
A number of pupils go solo but, of course, do not get their wings until they have completed a further ten months' course at an F.T.S., probably in Canada. They do, however, become acting pilot officers at the conclusion of their 12-week course.

On parade these National Servicemen are good—exceptionally so, bearing in mind the short time they have been in the service and the vast amount of other work to be crammed in at the same period.

A.V-M. Inglis, in a brief speech to the cadets and their guests, said how delighted he was to see No. 421 Squadron at Digby again and remarked that their visit was particularly appropriate in view of the fact that the cadets passing out that day would probably go to Canada for their flying training.

He asked the cadets to be ready at any moment to fight aggression and exhorted them to work and play hard, remembering that knowledge begets confidence and confidence courage.

At the end of the parade No. 421—having flown back to Waddington—brought their Vampires over in formation. The day closed with an exhibition of the craziest crazy-flying by Airwork instructors on Tiger Moths.



Some personalities at Digby: G/C. M. D. Lister, S.A.S.O., R.C.A.F.; A.V-M. G. Harcourt-Smith, A.O.C. No. 12 Group; A.Cdre. G. L. Sinclair, A.O.C. Cranwell; G/C. D. Lumgair, Station Commander and Asst. Commandant of E. and S. Wing, Cranwell; A.V-M. A. P. Ledger, A.O.A., Flying Training Command.

The scene in Scopwick churchyard during the sounding of the Last Post by an R.A.F. trumpeter.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Veterans at White Waltham

BRICKBATS are bestowed more readily than bouquets. Therefore, as a critic of veteran aircraft displays, may I raise a humble hat in agreement with your statement, concerning the 1951 White Waltham party, that "In our own view the honours of the day went to Gordon Banner in the Blackburn 1912 monoplane."

Scheduled late in the programme, when conditions might have improved, the Blackburn had, in fact, to contend with a wind which had increased and was nasty. A lengthy hop might have been expected; instead the pilot put up a very fine effort and, with controls not exactly up to Bristol Fighter standards, his right-hand turn downwind must have been anything but pleasant.

The Bristol Fighter was, of course, flown as of yore; they laughed when it taxied out, but the laughter changed somewhat after the take-off, which compared rather favourably with that of any other aircraft present—Hurricane excepted.

S/L. Neville Duke, I thought, stole a large portion of picture with his brilliant revival of the old-timers' "falling leaf."

One could not hear the energetic commentator unless in the immediate vicinity of an amplifier. However, as it is only 1951, I feel that it is unlikely that he exhorted the onlookers to watch the imminent retraction of the Hurricane's undercarriage, as I suggested might happen in the distant future in my article of December 21st last!

Potter's Bar, Middlesex. A. H. CURTIS.

"The Secret Years"

THE article appearing in the May 11th issue of *Flight* under the heading "The Secret Years" naturally attracted my attention.

I did notice, however, certain errors in reference to the testing of compressors. The power station in question was not Bedford but Northampton. An impression was given that Power Jets compressors were tested on that rig. Actually the permissible maximum speed was too low for these compressors and it was used for de Havilland, Armstrong Siddeley, Metrovick and Bristol units. The story of the La Mont boiler for the Whetstone test plant being diverted from a destroyer is picturesque but, I am afraid, apocryphal. As these rigs were both entrusted to the writer for their evolution and initial operation, I think these points should be made to ensure an accurate record of the events.

I have been a reader of *Flight* since its first issue. It has always set a high standard of accuracy, and this has been particularly true in relation to gas turbines at a time when many other papers frequently made mistakes. Perhaps I have been oversensitive to statements in connection with my contribution to the work of Power Jets, but I think *Flight* should be informed when it falls short of its traditional accuracy. FUNF.

Leicester.

[Our correspondent's *nom de plume* will not mask the identity of the writer from readers who were associated with the early development of the Whittle turbojet.—ED.]

Facing The Tail

WITH considerable interest I read that on March 20th members of the British Air Registration Board recommended to the I.C.A.O. Airworthiness Division that backward-facing seats should be adopted as a world standard in all aircraft carrying more than six passengers. Now that this vital subject is being aired in official quarters, I feel the time has come to dispel the hackneyed, dogmatic assertion that "passengers wouldn't like it." This argument, cherished by the Canutes of civil aviation, is based on the experience of a proportion of those who travel by road or rail.

Only one serious attempt has been made to analyze the reactions of airline passengers—a survey by the Air Transport Command of the United States Air Force. It was found that out of 1,020 passengers questioned after flying in rearward-facing seats, 94 per cent "favoured the arrangement, bearing in mind the safety advantage." Over 77 per cent found that "visibility" was improved. Speaking personally, on the basis of a few trips in R.A.F. Valettas with tail-facing seats, I can support the majority view most wholeheartedly.

Safety-mindedness can be carried too far, I admit; aircraft are not designed to crash, and elaborate safety devices are unnecessary today. But rearward-facing seats are no more complicated and no heavier than those in use on most airliners. Once the initial changeover had been made, they would be no more expensive to install. We know almost beyond doubt that in certain types of accident, notably crash-landings, rearward-facing seats reduce the incidence of death and injury. We are also certain that a few such accidents will occur in the future. Therefore an opportunity exists of cutting down future casualty-lists—without entailing any really great expense or inconvenience.

Los Angeles, California. A. D.

BRISTOL APPRENTICES REWARDED

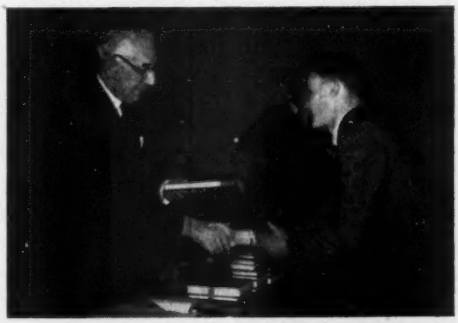
OVER twenty prizes and nearly forty certificates were distributed to successful apprentices of the Bristol Aeroplane Company's aircraft division at the recent annual prize-giving. The presentations were made by Mr. C. F. Uwins (managing director, aircraft division), who was introduced by Mr. R. S. Brown (general manager, aircraft division); also present were Mr. W. R. Verdon Smith (joint assistant managing director), Mr. N. Rowbotham (managing director, engine division) and other senior executives.

In a brief speech, Mr. Uwins said that the division had 332 apprentices under training at the end of April. Of the total of 289 who sat for the full-session examination in July last, 131 (45 per cent.) passed in all subjects.

Eighteen of 20 apprentices sitting for the Higher National Certificate were successful, and 19 out of 35 were successful in the Ordinary National Certificate. Eight gained City and Guilds Intermediate Certificates.

The prizes were distributed as follow:

Sir G. Stanley White Prize (most outstanding apprentice just completed training), D. W. Stowe, engineering apprentice; *W. R. Verdon Smith Prize* (best all-round up-graded trade apprentice in last year of training), D. J. Reed; *C. F. Uwins Prize* (best all-round engineering apprentice in last year of training), J. G. Price; *George White Prize* (best all-round trade apprentice in last year of training), R. H. Williams; *B. Davidson Prize* (progress and attainment during period of apprenticeship), J. D. Jones; *A. E. Russell Prize* (best all-round technical apprentice in last year of training), C. J. Adey; *General Manager's Prize* (best all-round fourth-year engineering apprentice), M. A. Hutchison; *Chief Development Engineer's Prize* (best all-round fourth-year trade apprentice), G. K. Rice; *Assistant General Manager's Prize* (best all-round third-year engineering apprentice), J. H. Kane; *Divisional Secretary's Prize* (best all-round third-year trade apprentice), J. D. Bendall; *Dunn Prize* (best all-round second-year engineering apprentice), L. T. Hodder; *Divisional Accountant's Prize* (best all-round second-year trade apprentice, P. B. Jenkins; *Commercial Manager's Prize* (best all-round first-year engineering apprentice), D. Ridler; *Sales Manager's Prize* (best all-round first-year trade apprentice), H. R. J. Debnam; *Service Manager's Prize* (progress and attainment during period of apprenticeship) D. Goold; *Production Manager's Prize* (progress and attainment during period of apprenticeship), D. L. Coveney.



Mr. C. F. Uwins, head of the aircraft division, presents his own prize to engineering apprentice J. G. Price.

Aircraft Division Merit Awards (outstanding trade or engineering apprentices worthy of recognition, and recommended by the heads of their departments), R. J. Hayter, R. G. Austin (candidate for College of Aeronautics), F. H. Chaffer (candidate for College of Aeronautics), D. R. Hooper, W. H. Williamson.

Aircraft Division Special Merit Award (ability and progress during period of apprenticeship), P. A. Knowles.

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